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PREDICTING DEVELOPMENT OF YOUNG ADULTS

William W. Cooley
Paul R. Lohnes

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and
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Major Project TALENT Publications

Flanagan, J. C., Dailey, J. T., Shaycoft, Marion F., Orr, D. B., Gorham, W. A., & Goldberg, I. *Designing the study.* (Technical report to the U. S. Office of Education, Cooperative Research Project No. 635.) Washington, D. C.: Project TALENT Office, Univer. of Pittsburgh, 1960.

Flanagan, J. C., Dailey, J. T., Shaycoft, Marion F., Gorham, W. A., Orr, D. B., & Goldberg, I. *The talents of American youth.* Vol. I. *Design for a study of American Youth.* Boston: Houghton Mifflin, 1962.

Flanagan, J. C., Dailey, J. T., Shaycoft, Marion F., Orr, D. B., & Goldberg, I. *Studies of the American high school.* (Final report to the U. S. Office of Education, Cooperative Research Project No. 226.) Washington, D. C.: Project TALENT Office, Univer. of Pittsburgh, 1962.

Shaycoft, Marion F., Dailey, J. T., Orr, D. B., Neyman, C. A., Jr., & Sherman, S. E. *Studies of a complete age group - Age 15.* (Final report to the U. S. Office of Education, Cooperative Research Project No. 635.) Pittsburgh: Project TALENT Office, Univer. of Pittsburgh, 1963.

Flanagan, J. C., Davis, F. B., Dailey, J. T., Shaycoft, Marion F., Orr, D. B., Goldberg, I., & Neyman, C. A., Jr. *The American high-school student.* (Final report to the U. S. Office of Education, Cooperative Research Project No. 635.) Pittsburgh: Project TALENT Office, Univer. of Pittsburgh, 1964.

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PREDICTING DEVELOPMENT OF YOUNG ADULTS

Project TALENT Five-Year Follow-Up Studies

Interim Report 5

Contract No. OE-610-065

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Table of Contents

Page

Preface iii

List of Tables iv

List of Figures ix

Chapter I. A THEORY OF ADOLESCENT PERSONALITY

Review of MAP 1-3
Studies of Change 1-12
Studies of Twins 1-21
The Generalizability of TALENT Results 1-30

Chapter II. PREDICTING EDUCATIONAL ADJUSTMENTS

The High School Years 2-3
    Curriculum Track
    Dropout

The College Years 2-13
    Type of college
    College Major
    College Dropout
    Graduate School
    Graduate Major
    Marital Status

Chapter III. PREDICTING OCCUPATIONAL PLACEMENTS

Vocational Placements Five Years Out of High School 3-16

Chapter IV. PREDICTING CAREER PATTERNS

Ginzberg and Associates 4-2
Super and Associates 4-8
Other Researchers 4-23
Previous TALENT results 4-33
The Career Development Tree 4-42

Chapter V. CAREER THEORY AND CAREER GUIDANCE

Career Development Theory 5-2
Career Guidance 5-10

Bibliography

Appendix A

Preface

Most of the research upon which this monograph is based was done during the academic year 1966-67, while we were still Director and Senior Research Scientists (respectively) at Project TALENT. The writing itself was done during the summer and fall of 1967.

Once again the authors wish to thank the many Project TALENT staff members who contributed to this effort, both before and during our association there. Also a debt of gratitude is due those thousands of young adults who continue to respond to the follow-up surveys, thus making this research possible.

We particularly want to thank Dr. John C. Flanagan, the "father" of Project TALENT, for the opportunity he provided us in working on this important project. Without him none of this would have been possible.

Finally, we want to express our hope that Project TALENT will receive the support necessary to carry on the longitudinal studies essential to realizing the initial goals of the project. The Office of Education has supported most of this work to date, but increased support seems necessary if the true potential of those data is to be realized. We wish TALENT's Director, Dr. Abraham Carp, much success in this and all other aspects of his new position.

William W. Cooley
Paul R. Lohnes

January 1968

List of Tables

Number	Title	Page
1.1	60 Ability Domain Variables	1-4
1.2	38 Motive Domain Variables	1-6
1.3	Factors for Two TALENT Batteries	1-7
1.4	Abilities Domain Variable-Factor Correlations $\geq .35$	1-9
1.5	Motive Domain Variable-Factor Correlations $\geq .35$	1-11
1.6	Correlations among 9th- and 12th-Grade MAP Abilities Factors Estimated on Retest Study Subjects	1-17
1.7	$R_{12.9}$, Partial Correlations among 12th-Grade MAP Factor Estimates after Removal of Multiple Regressions on 9th-Grade MAP Factor Estimates	1-19
1.8	Multiple Correlations of Factors with 45 Indicators: Three-year Stability Coefficients for Factors; and Change-factor Loadings of MAP Factors	1-20
1.9	Project TALENT Twins Study Heritability Analysis Results, with Variables Ranked for h^2 for Each Sex	1-27
1.10	Multiple Correlations of MAP Abilities Factors Regressed on Four Different Abilities Batteries (561 Subjects).	1-32
1.11	Bivariate Correlations between Each of 8 DAT Scales and 6 MAP Abilities Factors (561 Subjects)	1-33
1.12	Multiple Regressions of MAP Factors VKN, ENG, MAT, VIS, and PSA on Subsets of their TALENT Battery Indicators	1-35
1.13	PLAN A Factors and their TALENT Tests (unit weights for z scores)	1-37
1.14	Intercorrelations of PLAN A Factors	1-38
2.1	Twelfth-Grade Curricula and Sample Sizes (Williams, 1967,9)	2-4
2.2	Curriculum Group Centroids for 12th-Grade Males and Females on Best Predictors, with Multiple Correlations Coefficients for Factors	2-6
2.3	Factor-Discriminant Function Correlations and Canonical R Correlations for 12th-Grade Males and Females Curriculum Studies	2-7
2.4	Curriculum Group Centroids for 9th-Grade Males on Best Predictors, with Multiple Regression Coefficients for Factors	2-9

Number	Title	Page
2.5	Factor-Discriminant Function Correlations and Canonical R Correlation for 9th-Grade Male Curriculum Study	2-10
2.6	Discriminant Analyses of High School Male Dropouts versus High-School Graduates Who Do Not Seek Further Education, in the 9th-Grade MAP Factor Domains	2-12
2.7	Categories of Four-Year Higher Education Institutions Based on Size, Control and Instruction (Total N=994 Colleges)	2-17
2.8	Centroids and F-ratios for Seven College Groups on Twelve Astin Variables	2-18
2.9	Predictor-Discriminant Function Correlations for Study of Seven College Groups, with Canonical Correlations of Discriminant Functions with Group Variate Functions	2-19
2.10	Centroids in Three-Dimensional Discriminant Space for Seven College Groups	2-20
2.10A	Canonical Relationships Between Astin Dimensions and MAP Factors (N=4421 Male Students)	2-22
2.11	Major Field Groups of College-Graduate Males from 12th-Grade 5-Year Follow-Up	2-25
2.12	Major Field Group Centroids on Best Predictors, with Multiple Regression Coefficients for Factors	2-26
2.13	Factor-Discriminant Function Correlations for Major Fields of College-Graduate Males	2-27
2.14	Discriminant Function Centroids for 24 College Major Field Groups in Best Discriminant Plane of 12th-Grade MAP Space	2-28
2.15	Discriminant Analysis of Male College Graduates Attending Graduate School versus Male College Graduates Not Attending Graduate School, in 12th-Grade MAP Factors Space (Total N = 5095)	2-31
2.16	Graduate School Major Field Centroids on Best 12th-Grade MAP Predictors for 1975 Males	2-32
2.17	Factor-Discriminant Function Correlations for Graduate Major Fields in Male 12th-Grade MAP Space	2-33
2.18	Discriminant Function Centroids for 14 Graduate School Majors in Best Discriminant Plane of 12th-Grade MAP Space (N = 1975 Males; $T = 10_{z} + 50$)	2-35
2.19	Male College Dropouts Comparisons in the 12th-Grade MAP Factors Space (N = 3232)	2-36
2.20	Marital Status Five Years Out of High School Discriminant Analysis in the 12th-Grade MAP Factors Space (All 1628 Subjects are Males)	2-37

Number	Title	Page
3.1	Measurements Employed in 10,000 Careers	3-3
3.2	Occupation Group Means on Five Score Composites (grand mean = 0; s. d. = 100) (Thorndike & Hagen, 1959)	3-6
3.3	Percentage Correctly Classified into Each of Nine Groups and Percentage Expected on the Basis of Random Assignment (Madaus and O'Hara, 1967, 111)	3-12
3.4	Occupational Group Means on Best MAP Predictors (Five-Year Follow-up of 12th-Grade Males), with Multiple Regression Coefficients for Factors	3-17
3.5	Factor-Discriminant Correlations and Canonical Correlations for 40 Five-Year Follow-Up Occupational Placements in Twelfth-Grade MAP Space	3-19
3.6	Discriminant Function Centroids for Five-Year Follow-Up Occupational Groups	3-20
4.1	Career Development Stages	4-10
4.2	The Research Strategy	4-34
4.3	Occupational Aspirations of Males in High School and One Year Out, as Percent of Total Sample and Percent with Same Aspirations Both Times (12, 172, 175, 177)	4-36
4.4	Distribution of Stable and Changed Career Plans over Four Years for TALENT Ninth-Grade Males (12,183)	4-38
4.4A	Stability of Career Plans of Fifth-Grade Boys over Five Years	4-45
4.5	Four-Category Breakdown of 1964 Follow-up Plans, Contingent on Original Grade 9 (1960) Position on the People-Thing Dichotomy	4-47
4.6	Eight-Category Breakdown of 1964 Follow-Up Plans of Ninth-Grade Boys, Contingent on 1960 People-Thing Orientation (Table Entries and Percentages of Column Sample Size)	4-49
4.7	Percentages of Stable and Changed Career Plans over Four Years for TALENT Ninth-Grade Males on Four-Category Plans Criterion	4-50
4.8	Eight-Category Breakdown of 1964 Follow-Up Plans of Ninth-Grade Boys, Contingent on 1960 Status on Four-Category Plans Criterion (Table Entries are Percentages of Column Sample Sizes)	4-51
4.9	Unconditional Percentages of Twelfth-Grade Boys in Categories of Various Career Plans Criteria for High School and Follow-Up Data	4-52

Number	Title	Page
4.10	Eight-Category Breakdown of 1961 Follow-Up Plans of Twelfth-Grade Boys, Contingent on Four-Category 1960 Plans Status	4-55
4.11	Twelve-Category Breakdown of 1965 Follow-Up Plans of Twelfth-Grade Boys, Contingent on Four-Category 1960 Plans Status	4-58
4.12	Twelve-Category Breakdown on 1965 Follow-Up Plans of Twelfth-Grade Boys, Contingent on Eight-Category 1961 Follow-Up Career Plans Status	4-59
4.13	Percentages of Males Arriving in Each of 12 Career Categories on the Five-Year Follow-Up from Various Paths.	4-61
4.14	Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as High School Seniors and Planned College Biological-Medical Science Programs One Year Later. (N=565)	4-62
4.15	Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as Seniors and Planned College Physical Science Programs One Year Later. (N=1144)	4-62
4.16	Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as Seniors and Planned Noncollege Technical Training Programs One Year Later. (N=352)	4-63
4.17	Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as Seniors and Planned College Sociocultural Programs One Year Later. (N=898)	4-63
4.18	Group Means on Best MAP Predictors (with Multiple Regression Coefficients for Factors) for 1960 Twelfth-Grade Career Plans	4-66
4.19	Factor-Discriminant Correlations and Canonical Correlations for Twelfth-Grade Career Plans in Concurrent MAP Space	4-67
4.20	Discriminant Function Centroids for 1960 Twelfth-Grade Career Plan Groups	4-69
4.21	Group Means on Best MAP Predictors (with Multiple Regression Coefficients for Factors) for 1965 Five-Year Follow-Up Career Plans	4-73
4.22	Factor-Discriminant Correlations and Canonical Correlations for Five-Year Follow-Up Career Plans in Twelfth-Grade MAP Space	4-74

Number	Title	Page
4.23	Discriminant Function Centroids for 1965 Five-Year Follow-Up Career Plan Groups	4-75
4.24	Change Group (1960-1965) Means on Best MAP Predictors (with Multiple Regression Coefficients for Factors)	4-77
4.25	Factor-Discriminant Correlations and Canonical Correlations for 1960-1964 Career Plans Change Groups in Twelfth-Grade MAP Space	4-78
4.26	Discriminant Function Centroids for 1960-1965 Career Plans Change Groups	4-79
4.27	Discriminant Analysis of Six Vocational Aspiration Groups One Year Out of High School Predicted from 11 MAP Abilities Factors Measured in 9th-Grade on 2939 Male Subjects	4-82
4.28	Discriminant Analysis of Six Vocational Aspiration Groups One Year Out of High School Predicted from 11 MAP Motives Factors Measured in 9th-Grade on 2939 Male Subjects	4-83

List of Figures

Number	Title	Page
2.1	Twelfth-Grade Curriculum Group Means for Males and Females on First Discriminant Function	2-5
2.2	Ninth-Grade Curriculum Group Means for Males on First Discriminant Function	2-9
2.3	Centroids of College Major Fields in Discriminant Plane (Data in Table 2.14)	2-29
2.4	Centroids of Graduate School Major Fields in Discriminant Plane (Data in Table 2.14)	2-34
3.1	Centroids of Five-Year Follow-Up Occupations Groups in Discriminant Plane (Data in Table 3.6)	3-21
4.1	From Figure 2 in Appendix I of One-Year Follow-Up Studies (The 36 Centroids in the Ability Space)	4-39
4.1A	Project TALENT Career Development Tree	4-57
4.2	Centroids of 12th-Grade Career Plan Groups in Discriminant Plane.	4-70
4.3	Centroids of Five-Year Follow-Up Career Plan Groups in Discriminant Plane.	4-71
4.4	Centroids of Change Groups in Discriminant Plane	4-72

CHAPTER I

A Theory of Adolescent Personality

The great achievements of psychometric science during the past half a century have been the invention of a vast number of measurement procedures for scaling traits of personality, the elaboration of mathematical and statistical theory of measurement, the weaving of complex networks of traits and factors into models of personality, and the documentation and practical application of many concurrent and short-term predictive validities of measurements.

Although "personality" means different things to different people, a particulary operational definition has emerged from the resulting trait and factor methodology. First of all, a trait is defined as an enduring pattern of behaviors which is exhibited by all people, but in varying degrees. We describe human personality as a system of traits, so that a personality is the overall organization of the enduring patterns of behaviors exhibited by a person. What characterizes a person as an individual, different from every other individual, is his unique profile of degrees of intensity of those traits. These degrees of strength or weakness of a trait in different people are measurable from behavior samples, so that the trait profile which characterizes a particular personality can be represented by a set of scores. This set of scores can in turn be thought of as the person's location along a set of dimensions, one dimension for each measured trait. If there are $\underline{m}$ such traits or dimensions, then a person's personality can be represented as a point (or a vector) in that $\underline{m}$-dimensional space. This geometric model of personality is quite amenable to researchers and practitioners alike because matrix algebra and multivariate analysis provide the necessary tools for studying and describing points in an m-dimensional space.

During this half a century partisans of educational and psychological measurement have maintained that the traits of adolescence are predictive of the development of adulthood. To date, the evidence for this proposition is meager indeed, due to the paucity of longitudinal studies tracking individuals from their adolescence into adulthood. However, the previous achievements in trait measurement and their relationship to a theory of personality prepared the ground and created the need for a new style of large-scale, long-range,programmatic research into the long-range implications of personality measurement profiles of youth. Project TALENT was brought into existence, under the leadership of John C. Flanagan and with the support of the U. S. Office of Education, to pioneer this new style of longitudinal psychometric sampling survey research. In 1960, Project TALENT tested and inventoried almost half a million young people representing a probability sample of about five percent of American secondary school students, grades 9 through 12. The subjects were contacted by questionnaire during their first year out of high school, and again during their fifth year out, in the first stages of a follow-up program which should continue for many years to come. Five years out of high school the Project TALENT youths qualify as young adults, and the purpose of this monograph is to establish a number of important and useful predictive validities of their high school personality profiles for criteria of adult development. Since the import of these validities is for psychometric personality theory and a closely related theory of career development, and since the use of the findings will be in school guidance programs, we attempt to set the narration of our research into the context of a review and elaboration of guidance theory and a preview of new guidance practices.

The comprehensiveness, representativeness, and expansiveness of the Project TALENT data are such as to support and require a variety of research styles and orientations in the many different analytic operations conducted on them by a variety of agents and agencies. The research program of the present authors has its particular style and orientation, some of the features of which are 1) the reduction of approximately 100 test scores (traits) in the high school measurement battery to 22 basic personality factors, which are employed as the predictors in all studies; 2) the reduction of many-categoried educational and occupational follow-up items to rather simple taxonomies in terms of a small number of categories, which are employed as nominal-type criterion variables; 3) the use of multiple group discriminant analysis as the primary analytic method for relating antecedent personality factor profiles to posterior career adjustment categorical variables; 4) concentration on the search for trends in the major features of outcomes of the many separate discriminant studies that support higher-order generalizations in a theory of career development; and 5) continual concern to structure data analyses in ways that seem to promise maximal usefulness of the results in programs of career guidance for adolescents.

Review of MAP

This monograph is a sequel to Measuring Adolescent Personality (Lohnes, 1966), which reports the factor analytic research on the TALENT battery, describing both the 100 indicator scales and the resulting 22 factors in detail, and contains an extended essay on the multivariate research strategy and methods deployed in the studies to be reported here. Because of the title of the earlier monograph, the authors choose to refer to the predictors in this report as MAP factors. There are 11 abilities factors, extracted from 60 maximum performance scales of the TALENT battery (Table 1.1), and 11 motives factors, extracted from the 38 typical performance scales (Table 1.2). The 11 factors within each domain are mutually orthogonal (uncorrelated) for a given sex and high-school grade cohort. There are weak cross-correlations between factors of the two domains, as reported in the MAP monograph, which also reports on the systematic linear sex and grade effects in the factors. Since sex effects are heavy in our predictors and in most of our criteria, we have kept the sexes separate in our analyses. Table 1.3

Table 1.1: 60 Ability Domain Variables

	Mnemonic	Code	Name of Test
1	SCR	R-101	Screening
2	VOC	R-102	Vocabulary
3	LIT	R-103	Literature
4	MUS	R-104	Music
5	SST	R-105	Social Studies
6	MAT	R-106	Mathematics
7	PHY	R-107	Physical Sciences
8	BIO	R-108	Biological Sciences
9	SCA	R-109	Scientific Attitude
10	AER	R-110	Aeronautics and Space
11	ELE	R-111	Electricity and Electronics
12	MEC	R-112	Mechanics
13	FAR	R-113	Farming
14	HEC	R-114	Home Economics
15	SPO	R-115	Sports
16	ART	R-131	Art
17	LAW	R-132	Law
18	HEA	R-133	Health
19	ENG	R-134	Engineering
20	ARH	R-135	Architecture
21	JUR	R-136	Journalism
22	FOT	R-137	Foreign Travel
23	MIL	R-138	Military
24	ACC	R-139	Accounting
25	PRK	R-140	Practical Knowledge
26	CLE	R-141	Clerical
27	BIB	R-142	Bible
28	COL	R-143	Colors
29	ETI	R-144	Etiquette
30	HUN	R-145	Hunting
31	FIS	R-146	Fishing
32	OUT	R-147	Outdoor Activities (other)
33	PHO	R-148	Photography
34	GAM	R-149	Games (sedentary)
35	THR	R-150	Theater and Ballet
36	FDS	R-151	Foods
37	MIS	R-152	Miscellaneous

Further description of these variables can be found in Flanagan, _et al_., 1962.

Table 1.1 (continued)

	Mnemonic	Code	Name of Test
38	MMS	R-211	Memory for Sentences
39	MMW	R-212	Memory for Words
40	DSW	R-220	Disguised Words
41	SPL	R-231	Spelling
42	CAP	R-232	Capitalization
43	PNC	R-233	Punctuation
44	USG	R-234	English Usage
45	EXP	R-235	Effective Expression
46	WDF	R-240	Word Functions in Sentences
47	RDG	R-250	Reading Comprehension
48	CRE	R-260	Creativity
49	MCR	R-270	Mechanical Reasoning
50	VS2	R-281	Visualization in Two Dimensions
51	VS3	R-282	Visualization in Three Dimensions
52	ABS	R-290	Abstract Reasoning
53	ARR	R-311	Arithmetic Reasoning
54	MA9	R-312	Introductory Mathematics
55	ADV	R-333	Advanced Mathematics
56	ARC	R-410	Arithmetic Computation
57	TBL	R-420	Table Reading
58	CLR	R-430	Clerical Checking
59	OBJ	R-440	Object Inspection
60	PRF	A-500	Preferences

Table 1.2: 38 Motive Domain Variables

	Mnemonic	Code	Name of Scale
1	MEM	F-821	Memberships
2	LEA	F-822	Leadership Roles
3	HOB	F-823	Hobbies
4	WOR	F-824	Work
5	SOC	F-825	Social
6	REA	F-826	Reading
7	STU	F-827	Studying
8	CUR	F-828	Curriculum
9	COU	F-829	Courses
10	GRA	F-830	Grades
11	GUI	F-831	Guidance
12	NSO	R-601	Sociability
13	NSS	R-602	Social Sensitivity
14	NIM	R-603	Impulsiveness
15	NVI	R-604	Vigor
16	NCA	R-605	Calmness
17	NTI	R-606	Tidiness
18	NCU	R-607	Culture
19	NLE	R-608	Leadership
20	NSC	R-609	Self-Confidence
21	NMP	R-610	Mature Personality
22	IPS	P-701	Physical Science, Engineering, Mathematics
23	IBS	P-702	Biological Science, Medicine
24	IPU	P-703	Public Service
25	ILL	P-704	Literary, Linguistic
26	ISS	P-705	Social Service
27	IAR	P-706	Artistic
28	IMU	P-707	Musical
29	ISP	P-708	Sports
30	IHF	P-709	Hunting, Fishing
31	IBM	P-710	Business Management
32	ISA	P-711	Sales
33	ICO	P-712	Computation
34	IOW	P-713	Office Work
35	IMT	P-714	Mechanical, Technical
36	IST	P-715	Skilled Trades
37	IFA	P-716	Farming
38	ILA	P-717	Labor

Table 1.3: Factors for Two TALENT Batteries

Mnemonic	Factor Name	Variance Extracted
	ABILITIES DOMAIN FACTORS	
VKN	Verbal Knowledges	18.7 %
GRD	Grade	7.8 %
ENG	English Language	6.6 %
SEX	Sex	5.7 %
VIS	Visual Reasoning	5.3 %
MAT	Mathematics	4.1 %
PSA	Perceptual Speed and Accuracy	3.6 %
SCR	Screening	3.3 %
H-F	Hunting-Fishing	2.2 %
MEM	Memory	2.1 %
COL	Color, Foods	1.9 %
ETI	Etiquette	1.6 %
GAM	Games	1.5 %
(13 factors extract 64.6 % of variance)		
	MOTIVES DOMAIN FACTORS	
CON	Conformity Needs	11.1 %
SEX	Sex	9.1 %
BUS	Business Interests	8.7 %
OUT	Outdoors, Shop Interests	6.8 %
SCH	Scholasticism	6.6 %
CUL	Cultural Interests	5.8 %
SCI	Science Interests	4.3 %
GRD	Grade	4.2 %
ACT	Activity Level	4.0 %
LEA	Leadership	3.1 %
IMP	Impulsion	2.8 %
SOC	Sociability	2.8 %
INT	Introspection	2.4 %
(13 factors extract 71.5 % of variance)		

lists the 11 factors of each domain, with mnemonics for them that are used throughout this text, while Table 1.4 presents the main features of the factor pattern for the ability domain, and Table 1.5 for the motives domain.

The ability factors can be viewed, as an aid to remembering them, in the following structure.

Core Educational Achievements

VKN	Verbal Knowledges, a *g* factor
MAT	Mathematics
ENG	English Language

Differential Aptitudes

VIS	Visual Reasoning
PSA	Perceptual Speed and Accuracy
MEM	Memory

Specialized Knowledges

H-F	Hunting-Fishing
SCR	Screening
COL	Color, Foods
ETI	Etiquette
GAM	Games

Two factors, Verbal Knowledges and Mathematics, turn out to be the powerful predictors in most of our studies.

The motive factors are perhaps made memorable by this structure:

Indicators	Factors	
"N," adjectival self-concepts	CON	Conformity Needs
	IMP	Impulsion
"A," autobiographical activities	SCH	Scholasticism
	ACT	Activity Level
"I," inventoried interests	BUS	Business
	OUT	Outdoor and Shop
	CUL	Cultural
	SCI	Science

Table 1.4: Abilities Domain Variable-Factor Correlations ≥ .35

Test	VKN	GRD	ENG	SEX	VIS	MAT	PSA	SCR	H-F	MEM	COL	ETI	GAM	h^2	R^2
SCR								61						64	40
VOC	66													79	78
LIT	69	42												76	73
MUS	65													63	59
SST	70													77	76
MAT	45					62								82	75
PHY	54					42								74	71
BIO	51													63	56
SCA	47													52	49
AER	50			42										63	57
ELE	36			44										69	64
MEC				52				38						74	69
FAR	36							47						65	50
HEC				-52										66	59
SPO	48			39										57	55
ART	72													68	63
LAW	61	35												58	53
HEA	56													60	56
ENG	39													48	42
ARH	53													40	33
JUR	58													49	45
FOT	68													57	50
MIL	59													51	38
ACC	54	39												54	53
PRK	47													58	46
CLE		53												51	48
BIB	63													60	45
COL											66			65	27
ETI												71		79	21
HUN				43					58					59	34
FIS									77					74	23
OUT	50													55	49
PHO	41													40	30
GAM	41												46	53	29
THR	65													64	60
FDS	46										51			59	35
MIS	63													56	52
MMS										83				86	20
MMW										50				57	38
DSW	46		40											65	58
SPL			58											67	56
CAP			62											59	43
PNC	38		60											75	69

Table 1.4 (continued)

Test	VKN	GRD	ENG	SEX	VIS	MAT	PSA	SCR	H-F	MEM	COL	ETI	GAM	h^2	R^2
USG	36		59											62	54
EXP			53											57	46
WDF	40		42											66	58
RDG	65	35	39											81	79
CRE	46				41									57	53
MCR				44	59									73	66
VS2					63									57	36
VS3					71									66	49
ABS					57									64	54
ARR	41		39											66	63
MA9	39		36			61								79	73
ADV						71								69	46
ARC			46				36							67	54
TBL							71							59	36
CLR							76							65	38
OBJ							67							62	35
PRF							56	35						64	18

Table 1.5: Motive Domain Variable-Factor Correlations $\geq .35$

Test	CON	SEX	BUS	OUT	SCH	CUL	SCI	GRD	ACT	LEA	IMP	SOC	INT	h^2	R^2
MEM									60					61	31
LEA										83				75	17
HOB									62					68	44
WOR									71					64	29
SOC												62		66	26
REA					39								55	66	25
STU					72									74	52
CUR					70									62	35
COU					53			44						56	40
GRA					75									66	41
GUI					55									54	39
NSO	63											43		68	48
NSS	72													66	56
NIM											87			83	16
NVI	67													61	45
NCA	74													66	52
NTI	75													68	53
NCU	72													70	58
NLE	51									44				61	39
NSC	45												66	76	30
NMP	78													75	64
IPS		47					62							82	77
IBS							74							75	56
IPU			51				37							64	55
ILL			39			68								82	73
ISS		-49	46			35								65	63
IAR						70								70	55
IMU						77								70	44
ISP		35		50										68	50
IHF		50		61										72	58
IBM			74											78	71
ISA			74											68	58
ICO			79											73	62
IOW		-55	62											74	67
IMT		63		51										80	83
IST		35	45	67										84	81
IFA				77										73	55
ILA			45	61										79	68

"N" and "A" scales	LEA	Leadership
	SOC	Sociability
	INT	Introspection

Scholasticism (or academic orientation) and the four interest factors (BUS, OUT, CUL, SCI) turn out to be the most generally potent predictors from this domain.

To summarize then, the personality of an adolescent of a given grade and sex is represented by his set of scores on these 22 MAP factors. The primary purpose of this monograph is to describe the relationship between adolescent personality and the educational and vocational development of young adults, criteria for the latter being developed from the Project TALENT follow-up studies. This relationship seeking is set in a context of career development theory and a concern for guidance practice.

Studies of Change

Before considering the predictive validities for career criteria of the MAP factors, it seems useful to review some new lines of evidence on the etiology and stability of the abilities factors. The recently completed Retest Study (Shaycoft, 1967), based on a panel of about 7500 ninth-grade TALENT subjects who were retested in the twelfth grade, has provided one opportunity to inquire, at least obliquely, into the stability of the main abilities factors. Shaycoft reports the factor-analytic exploration of the correlations among and across 48 of the maximum performance tests of the TALENT battery. Although her methodology varied from that employed in creating the MAP factors, her factor solution for the major dimensions of the abilities domain is quite similar to the MAP solution. A basic objective of her study, however, was to permit the emergence of "change" factors such as could only appear in retest data. The issue is whether there are factors that explain changes in status on the 48 indicators in addition to the factors that explain status on the indicators at grade 9 or 12. Insofar as twelfth-grade status on the 48 tests is predictable from ninth-grade status, and Shaycoft's major finding is that it mostly is so predictable, the need for new explanatory constructs, i.e. change factors, is diminished.

Defining a residual change in an indicator as that part of the twelfth-grade score which is not predictable from the ninth-grade profile of scores, it is the correlations among these residuals that is to be accounted for by change factors. Such change factors could logically be attributed by differences in experiences of the subjects over the three-year retest period. An important class of experience variables to which such change factors could be traced is differential educational treatments, including school, curriculum, and teacher effects. Abilities change factors, as sought by Shaycoft, could provide ideal criterion or outcome variables for studies of secondary education prescriptions. Unfortunately for such research, Shaycoft is able to extract only two change factors, and the variance in behaviors they account for is rather slight. She finds a factor she terms Gain in English Skills operating for both sexes, and a factor she terms Gain in General Information operating for the males only. Her overall conclusion is that "aptitudes," as revealed by ninth-grade test scores, are much more important in accounting for twelfth-grade test performances than are any variables that might be traced to intervening differential educational experiences.

The issue of how to explain growth in intellectual abilities that occurs in the period of middle adolescence and secondary education is a vital one for educational psychology, yet its resolution is clouded by extremely serious methodological obstacles. Bloom (1964) has given one of the best surveys of the research literature on development of measurement traits. However, we feel that his model for manipulating test-retest correlations has lead him to overly optimistic conclusions regarding the opportunities for differential treatments to influence the growth of traits of ability during the early childhood periods of rapid growth. Although he correctly describes negatively accelerated parabolic curves as typical of abilities, so that the growth spurts tend to come early, his questionable mathematical model leads him to inflated estimates of proportions of variance due to environmental variables during growth periods. Thorndike (1966) has given the mathematical problems in test-retest studies of change a thorough and rigorous treatment, which sheds light on Bloom's procedures. Nevertheless, Bloom's assembled evidence does seem to support considerable pessimism regarding the potency of educational environment during adolescence to influence the structure of abilities, even as Shaycoft's study does. Bloom concludes with an eloquent plea for the construction of reliable and valid measures of change in ability, and the replacement with them of present school grading practices. He says:

> Thus it is evident that grades based on annual measures are little more than a reflection of where the students were on the scale when they began the year. One might question the propriety of a grading system where the grades at the end of the year could have been assigned with great accuracy before the students began the year... grades should be based on gains or growth rather than on final status. (Bloom, 1964, 114-15)

At another point he argues:

> Under present grading practices for stable characteristics individuals are likely to be repeatedly rewarded or punished for characteristics they possess at the beginning of a school term, whereas the gains they make during the school term are largely ignored, Thus two individuals may make equal progress during a given school year but be given very different grades at the end of the year because they started at different points at the beginning of the year. The consequences of repeated success or failure over several school years must surely have major effects on the individual's view of himself and his attitudes toward school and school learning. (Bloom, 1964, 128)

The great significance of Shaycoft's study is that by bringing the methodological rigor Thorndike prescribes to bear on retest data on an adequate sample of adolescents and of ability traits, she shows how change variables in the areas of English language skills and general verbal knowledges can be scaled, and at the same time shows that these will not be vastly useful variables in the measurement profiles of adolescents.

What are the implications of Shaycoft's retest study analyses for the question of the constancy of the structure of intellect given by the MAP abilities factors over the high school years? Readers of the earlier monograph on the MAP factors (Lohnes, 1966) will recall that the assumption of constancy of structure over middle adolescence was forced on the data by the method of analysis. That model assumed that growth or change increments in personality factors during this period could be accounted for by the grade parameters of a linear model, and that sex differences could be accounted for by the sex parameters of such a model. The control factors of grade and sex were factored out of a total sample correlation matrix, based on ninth- and twelfth-grade subjects of both sexes, to remove the impact of correlations among the linear model parameters from the total correlations. This left covariances due to individual differences as the basis for the MAP factors, to the extent that the model holds. Some support for this model can be induced from the similarities of factor structures for the four separate sex-grade cells of the design. Undoubtedly, however, retest data provide the ideal basis for studying constancy of factor structure over several years of development. Shaycoft found two change variables based on the original TALENT abilities tests. What we want to know is whether the retest ninth-to-twelfth-grade correlations she generated will support any change variables based on the MAP factors. The job of transforming her inter-test correlations into inter-factor correlations is complicated because she does not have all 60 tests of the TALENT battery, yet all 60 tests have coefficients in the linear functions that define the MAP abilities factors. The shortage is not crippling, however, because 10 of the 12 tests missing from the retest data are information tests, and there are 27 additional information tests that are present. Verbal Knowledges is the only major MAP factor extracted from the 37 information tests, and it can be very well estimated from the subset of 27 tests available. The minor factors of Screening, Memory, Color and Foods, Etiquette, and Games cannot be estimated because key indicators are missing, but the six major factors,

VKN	Verbal Knowledges
MAT	Mathematics
ENG	English Language
H-F	Hunting-Fishing
VIS	Visual Reasoning
PSA	Perceptual Speed and Accuracy

can be estimated on the retest data. The procedure for doing this is summarized in Appendix A. The resulting matrices of correlations between and across ninth- and twelfth-grade MAP factor scores estimated for the retest study subjects are reported in Table 1.6. The approximations to zero intercorrelations among the ninth-grade factor scores and among the 12th-grade factor scores are pretty good, considering that the 7600 retest subjects are in no way a random subsample from the total TALENT sample, as the original MAP analysis subjects were. The two 9th-12th cross-correlation matrices are very nearly diagonal also. Their diagonal elements are termed "stability coefficients," since they represent the test-retest correlation for each factor over the three-year period. The very low values for Hunting-Fishing on the females and Perceptual Speed and Accuracy on both sexes are presumably due in part to low reliabilities for female H-F and for both sexes on PSA, to be reported on later in this chapter. We will show a female H-F reliability estimate of .19! With respect to the PSA indicators, which are highly speeded tests, we have reason to suspect some anomalies in retest administration. Theoretically, the PSA factor is based on psychomotor capabilities of the nervous system that are not very trainable, and the factor should be quite stable over time.

Additional modes of analysis are suggested by these retest results. The first is canonical correlation, between the grade 9 factors and the grade 12 factors. For each of the sexes, the first canonical $\underline{R}$ is .9, and it relates a 9th-grade linear combination of the form

$$\text{VKN} - (\text{ENG} + \text{MAT})$$

to a 12th-grade combination of the same form. Thus, canonical correlation suggests that the most stable variable that can be

Table 1.6: Correlations Among 9th and 12th-Grade MAP Abilities Factors Estimated on Retest Study Subjects (Male Results Above the Diagonal; Females Below the Diagonal)

		9th Grade						12th Grade					
		VKN	MAT	ENG	H-F	VIS	PSA	VKN	MAT	ENG	H-F	VIS	PSA
12th	VKN	1.00	-.09	.21	-.02	.12	.00	.76	.00	-.06	.02	.00	.00
	MAT	-.04	1.00	.16	-.10	.08	.07	-.19	.52	.28	-.04	.14	.10
	ENG	.14	.06	1.00	.06	-.05	.07	.00	.05	.51	.06	-.07	.16
	H-F	.16	-.06	.08	1.00	-.12	-.06	-.01	-.09	.08	.60	-.01	-.06
	VIS	.06	.04	-.01	-.15	1.00	.14	.04	.06	-.04	-.05	.64	.04
	PSA	.12	.10	.24	.03	.13	1.00	-.04	.02	.08	-.07	.04	.33
9th	VKN	.77	-.14	.01	.12	.00	-.02	1.00	.05	.07	.00	.08	-.01
	MAT	.04	.44	.07	-.02	.02	.06	.09	1.00	.06	-.11	.04	-.09
	ENG	-.16	.14	.47	-.01	.06	.10	.05	.02	1.00	.10	-.01	.10
	H-F	.09	-.05	.00	.29	-.09	-.06	.12	-.03	.07	1.00	-.08	.03
	VIS	-.06	.15	.04	-.07	.65	.10	.01	-.09	.06	-.13	1.00	.10
	PSA	.04	.04	.21	-.03	.12	.41	.01	-.05	.10	.05	.14	1.00

based on the six MAP ability factors is a contrast between general intelligence and the sum of English and mathematics abilities. The second, and more interesting approach is to form and study the matrix of correlations among residual scores on 12th-grade MAP factors after the multiple regressions of the 12th-grade factors on the 9th-grade factors have been removed. The resulting partial correlations for males and females are reported in Table 1.7. Note that the two matrices are very similar, and that the only sizable correlation in either is between VKN residual and ENG residual. We should not be surprised that the major change variable located by factoring each matrix of partials is loaded .9 on VKN and .8 on ENG, and is primarily a factor of correlated changes in Verbal Knowledges and English Language. Table 1.8 gives the full set of factor loadings on this change variable for both sexes. Our single change variable based on the MAP abilities factors is obviously a somewhat different finding from Shaycoft's two change variables based on the 48 tests, but since her change variables pointed to changes in English skills and in information skills, and so does ours, the findings can be assimilated. The main point in our analysis, which is the very low values in the partial correlation matrices, certainly parallels Shaycoft's main conclusion that change variables are not very important dimensions of adolescent abilities structure.

Three distinct generalizations about the MAP factors model of adolescent intellect seem to follow from these analyses of the Retest Study data. First, the moderate to low three-year stability coefficients for the six MAP factors indicate that meaningful changes in the separate abilities do occur during the high school years. Verbal Knowledges is shown to be the most stable ability factor. It would be very useful to have research done on the environmental correlates of the changes in status on these abilities during high school. Second, the very low partial correlations indicate that the structure of intellect provided by the six major MAP abilities factors is predominately stable over the high school years, which corroborates the application of our factor model for abilities

Table 1.7: $R_{12.9}$, Partial Correlations among 12th-Grade MAP Factor Estimates after Removal of Multiple Regressions on 9th-Grade MAP Factor Estimates (Male Results above the Diagonal: Female below the Diagonal)

	VKN	MAT	ENG	H-F	VIS	PSA
VKN	1.00	.20	.44	-.02	.25	.05
MAT	.21	1.00	-.08	-.09	-.19	-.17
ENG	.46	-.06	1.00	.07	-.01	.00
H-F	.06	-.01	.12	1.00	-.15	.09
VIS	.22	-.23	-.07	-.16	1.00	.13
PSA	.05	-.10	-.01	.10	.07	1.00

Table 1.8: Multiple Correlations of Factors with 45 Indicators; Three-Year Stability Coefficients for Factors; and Change-Factor Loadings of MAP Factors

MAP Factor	Mult R with 48 Indicators	Retest Stability Coefficients		Loadings on the Change-factor	
		Males	Females	Males	Females
VKN	.95	.76	.77	.87	.89
MAT	.97	.52	.44	.14	.17
ENG	.93	.51	.47	.81	.78
H-F	.93	.60	.29	.12	.19
VIS	.96	.64	.65	.20	.19
PSA	.96	.33	.41	.07	.09

over the span of middle adolescence, and the assumption that a linear model for each orthogonal factor suitably accounts for changes in factor status. The possibility of employing a change dimension based on correlated changes in VKN and ENG does emerge, but the covariance in residuals on which this variable depends is so small that it is unlikely the variable will be servicable. Third, the finding that the most preditable criterion based on the six MAP factors for the three-year interval has the form VKN - (ENG + MAT) suggests that ninth-graders whose developed skills in English and mathematics are in sharp contrast to their general verbal ability tend to maintain that contrast over the high school years.

Studies of Twins

Twin studies have long enjoyed a special status in the methodology of the psychology of individual differences because they can shed some light on the heredity-environment issue, and because of the large control over error variance achieved when twins are split between experimental treatments. Researchers with access to twin pairs are fortunate indeed. The Project TALENT sample contains over two thousand same-sex twin pairs! One of Project TALENT's scientists, Lyle Schoenfeldt, has concentrated his attention on these twins, and using results of a special questionnaire he sent to them, he has been able to classify 524 same-sex twin pairs for zygosity. One phase of his work with these typed pairs involves the MAP ability factors, so we have the advantage of evidence on the heritability of our variables.

Besides the matter of natural curiosity, there are two reasons why we might be interested in examining the heritability of personality traits. Consideration of the mechanisms of heredity leads us to perceive "the absolute uniqueness of each individual genotype" (Hirsch, 1967, 120). We are encouraged to eschew typologies in our psychology, and to pursue the study of individuality.

> Individuality, uniqueness, is not outside the competence of science, It may, in fact it must, be understood scientifically. In particular, the science of genetics investigates individuality and its causes. The singularity of the human self becomes comprehensible in the light of genetics. (Dobzhansky, 1967, 41)

It is a geneticist who states flatly:

> Every person is unique, unprecedented, and unrepeatable. (Dobzhansky, 1967b, 42)

Surely educators need to take this truism more to heart. The second reason we might emphasize heritability of traits is to temper our enthusiasm for our programs that try to shape human personality. It is easy for us to overestimate the potency of our educational arrangements. Heritability studies inform us that the part of variance in many traits due to genetics is large, and indeed that it may grow as the variation in human environments is reduced

> As the social, ethnic, and economic barriers to education are removed throughout the world, and as the quality of education approaches a more uniformly high level of effectiveness, heredity may be expected to make an ever larger contribution to individual differences in intellectual functioning and consequently to success in our increasingly complex civilization. (Hirsch, 1967, 128)

The same point is made by another geneticist:

> As equality of opportunity is approached, will the significance of the gentic differences among men be reduced to naught? The truth is the exact opposite....In exactly uniform environments all differences would be genetically determined. (Dobzhansky, 1967a, 413)

Detailed knowledge about the differential heritability of traits will help us to know which traits are most amenable to modification by schooling. It does not necessarily follow that the traits on which school means show the greatest variance are the traits most affected by schooling variations. Jensen (1967) criticizes Equality of Educational Opportunity (Coleman, et al., 1966) for basing its analyses of the effects of school variables on a verbal intelligence test criterion when the authors had subject-matter achievement tests available.

> The intelligence test was used in preference to the achievement tests only because it revealed larger and more consistent differences between schools than did the achievement tests. Measures of school achievement...yield much lower values of $\underline{h}^2$ (heritability) than do measures of intelligence. Thus, it would have been far more defensible to compare schools on those achievement variables that are most highly influenced by environmental factors rather than on measures which are determined in large degree by innate factors. By basing the main conclusions of the study on the one test having probably the highest heritability, namely, the verbal intelligence test, the investigators minimized the chances of clearly revealing the effects of inequalities of public educational facilities on scholastic achievement *per se* and maximized the probability of finding school differences based mainly on pupil selection... (Jensen, 1967, 12)

Jensen goes on to observe that Coleman and his colleagues must have had about 7,000 twin pairs among their 650,000 subjects, and that if they had focused attention on their twins to produce heritability estimates for the various tests the results might have been crucial in establishing the proper interpretations of among-school differences.

How heritable is general intellectual ability? Are special abilities as heritable as general ability? Nichols (1965) reviews the twins-study literature on these two issues, and adds the support of his own study of 1169 same-sex, zygosity-typed twin pairs to the trends he finds in the literature. He shows that there is ample evidence for the proposition that "heredity accounts for about the same hereditary character as the more general ability" (*ibid*. 8). His overall conclusion is:

> These findings are most consistent with a theory of intelligence which assumes a large number of components of ability which are inherited independently and which are influenced by environment to a relatively small degree. (*ibid*. 9)

Elsewhere, Nichols looked at interests and other motives scales for these same twin-pairs (Nichols, 1966, 2), but the inconsistencies in his findings across sexes, across instruments, and with the model for the heritability coefficient $\underline{h}^2$, lead him to describe either data or his analyses (we are not sure which) as "vermicular" (ibid.,16). So convinced is he that something is worm-eaten that he concludes his paper with the assertion that if twin studies on personality inventory scales "are to serve as bait for the advance of theory rather than as maggots consuming a carrion line of research, the first order of business is to find some way of obtaining reproducible results" (ibid.,17).

In an extremely stimulating paper, Nichols (1966c) has taken a very broad look at what the literature and National Merit Scholarship Corporation research imply about "The Origin and Development of Talent." He finds there is ample evidence that high achievement runs through generations in particular families. There is good evidence that differences in school and college environments "have little effect on the career plans, intellectual achievement, or personality of talented students" (ibid.,13). The only developmental influences on talented people research has firmly established are the related variables of birth order and sibling spacing. Early birth order and large sibling spacing seem to be conducive to emergence of talent. Nichols' generalization is that genetic endowment has most to do with the origin of talent, family circumstances some to do, and educational treatments least to do with the variability in talent in our society.

In an extensive survey of "Contributions of Twin Research to Psychology" Vandenberg (1966) has arrived at the same position as Nichols, that there are several independent dimensions of innate ability. He states all the difficulties with h^2 type point estimates of proportion of variance due to heredity, but points out that the twin method surely "may be used to rank a number of variables in order of the contribution of heredity components to the total variance in each of those variables, especially if these variables are all measured in the same group of twin pairs" (Vandenberg, 1966, 329). We will argue that an approximate ranking of the MAP factors is possible and useful.

Jensen (1966) also proposes a revision in methodology for twin studies. He says "the twin method...provides both the most efficient and the least ambiguous basis for an overall estimate of heritability of quantitative traits," and he defines heritability "as the proportion of phenotypic variance attributable to genotypic variance, i.e., $h^2 = \sigma^2_G / \sigma^2_P$" (Jensen, 1966, 1). The problem is to obtain convincing estimates of the variances in the ratio. He shows the shortcomings of Holzinger's classical equation

$$H = \frac{r_{MZ} - r_{DZ}}{1 - r_{DZ}}$$

(Comtemplate that for $r_{MZ} = 1.00$ and $r_{DZ} = .99$, $H = 1.00$!)

and Nichols' recent proposal

$$HR = \frac{2(r_{MZ} - r_{DZ})}{r_{MZ}}$$

(For $r_{MZ} = .40$ and $r_{DZ} = .20$, $HR = 1.00$!),

and proposes a new formula involving an additional parameter to be estimated:

$$h^2 = \frac{r_{MZ} - r_{DZ}}{1 - \rho_\infty} \qquad \text{(Jensen, 1967, 4)},$$

where ρ_∞ is the genetic correlation between siblings, to introduce a factor for the degree of assortative mating. The upper limit for ρ_∞ is .66 (a self-mated mother) whereas for random mating ρ_∞ is .50, and for negative assortive mating it would go below .50. Assuming that assortative mating on intelligence puts ρ_∞ at .55, and using median values for r_{MZ} and r_{DZ} from the many estimates in the literature, Jensen concludes that for intelligence $h^2 = .80$, $E^2 = .12$ (environmental variance), and $e^2 = .08$ (error variance). "Thus, according to these data--the average of all the major twin studies--four times as much of the variance in measured intelligence is attributable to heredity as to environment" (*ibid.*, 7).

Jensen's $\underline{h}^2$ model requires corrected correlations for its computation. Schoenfeldt has put a great deal of effort into correcting his intraclass correlations, r_{MZ} and r_{DZ}, for attenuation due to unreliability and to restriction of range in his samples. In the process he has generated useful estimates of the MAP factor reliabilities, which we report later. On the assumption of random assortative mating he has computed h^2 values for the eleven MAP abilities separately for each sex. As Jensen pointed out, a prerequisite for a meaningful $\underline{h}^2$ estimate is an $\underline{F}$-test value for the ratio of within dizygotic pairs variance to within monozygotic pairs variance sufficiently large to reject the null hypothesis of equal population variances, "if $\underline{F}$ is not statistically significant, $\underline{h}^2$ cannot be presumed to differ significantly from zero" (Jensen, 1967, 2).

Schoenfeldt has made some preliminary tests of the MAP factors using those procedures on a sample of twins for whom complete data are available at this time. Table 1.9 reports the results for the MAP ability factors which have h^2 values that are significantly different from zero at the .05 level. For both sexes, Verbal Knowledges has a high h^2 value in the range we would expect from the literature although in each sex one of the "aptitudes" has a higher $\underline{h}^2$ value that does VKN. At first glance the extent of differences in results for the sexes is shocking, but then there appears to be some sense in the conflicting results, in that abilities which are not emphasized in the schooling of a sex tend to be higher on $\underline{h}^2$ for that sex than are abilities that are stressed in schooling. Thus, boys are known to be more able on Visual Reasoning than girls, but their $\underline{h}^2$ value for VIS is low and that for girls is high. Girls are more able on English Language than boys, but their $\underline{h}^2$ value for ENG is low and that for boys is high. Boys are poorer performers than girls on Memory, but their $\underline{h}^2$ for MEM is high. Girls are poorer than boys on Mathematics, but their $\underline{h}^2$ on MAP is larger than their $\underline{h}^2$ on ENG, at which they excel. Perhaps the rule is that the environment tends to have greater influence on variance of those abilities it presses.

Table 1.9: Project TALENT Twins Study Heritability Analysis Results, with Variables Ranked for h^2 for Each Sex*

Rank		σW_{MZ}	σW_{DZ}	Reliability Corrected r_{MZ}	Reliability Corrected r_{DZ}	h^2
Males (150MZ, 53DZ pairs)						
1	MEM	.516	.886	.631	.150	.96
2	VKN	.217	.612	.870	.434	.88
3	ENG	.346	.623	.792	.459	.67
4	VIS	.317	.475	.794	.612	.37
Females (103DZ, 187MZ pairs)						
1	VIS	.345	.656	.856	.450	.81
2	VKN	.187	.481	.950	.608	.69
3	PSA	.299	.551	.816	.523	.59
4	MAT	.375	.535	.890	.664	.45
5	ENG	.394	.548	.806	.603	.41

* $F = \sigma W_{DZ}{}^2/\sigma W_{MZ}{}^2$ nonsignificant at .05 level for unreported MAP abilities factors. Table from L. F. Schoenfeldt.

Incidentally, Schoenfeldt's use of $\rho_\infty = .50$ in computing $\underline{h}^2$, on the assumption of random mating, makes sense for all the abilities other than Verbal Knowledges, but it may be that for VKN the value $\rho_\infty = .55$ is more convincing. For this assumption, we compute $\underline{h}^2$ for VKN for males to be .98, and $\underline{h}^2$ for VKN for females to be .76.

If there is an optimistic view of these results for educators, it resides in the suggestion that under the right conditions over half the variance in the English Language, Mathematics, and Visual Reasoning factors can be the result of differential between-families environments. Presumably much of this could be due to differential educational treatments. In the later chapters we will show that the Mathematics and Visual Reasoning factors are particularly important determinants of male career adjustments, so the finding that most of the variance on these factors for males can be attributed to environmental influences is quite positive for educational psychology.

One genetically-determined human characteristic that has enormous influence on personality is sex. There is evidence in studies of human infants of "sharp differences" in behavior traits between boys and girls that emerge "too early in life to have been caused by the environment" (Yolles, 1967, 65). Eleanor E. Maccoby has edited a book titled _The Development of Sex Differences_ (1966) which summarizes some 900 studies in this area of early childhood differences. A book which makes it clear that sex differences are magnified in adolescence is Elizabeth Douvan and Joseph Adelson's _The Adolescent Experience_ (Wiley, 1966). This book, based on survey interviews with a national sample of about 3,000 youths, is an excellent complement to the Project TALENT reports, because it concentrates on the phenomenology of adolescents whereas TALENT concentrates on the behavioral repertoires and subsequent adjustments of adolescents. A few quotes from the authors' summary illustrate the differences they found.

> The style and focus of future orientation differs sharply for boys and girls....Boys tend to concentrate on the vocational future and their style is all business-concrete, crystallized, tied to reality, if not always realistic.... Girls focus on the interpersonal aspects of future life--on marriage and the roles of wife and mother. (Douvan and Adelson, 1966, 342)

> Mobility aspiration for the boy is no idle dream, it is rather the concrete expression of a boy's faith in himself. The goal he chooses is realistic in light of his talent and opportunities, but is not overblown....The girl's mobility aspirations are less formed and less fettered by reality. She need not test her desire against her own talent and skill, since these will not be crucial determinants of her future status. Her access to higher status will come through marriage. For most of these girls...marriage itself has so little reality....Since it is all a dream, in any case, one may as well dream big. Girls' mobility plans are less careful than boys', less cautioned by an assessment of opportunity. They are more simply dreams. (*ibid*., 343)
>
> Girls use peer relationships differently. They are not as tied to a group as such, nor are they sensitized to the pressure of "the gang" (except possibly in issues of taste). In general girls are more attracted to close two-person friendships. (*ibid*., 344)

Reflecting on their own experience with studying the adolescent experience, the authors say frankly, "What we did not anticipate was the force of the sex variable, the extent to which it defines and shades all aspects of the developmental crisis" (*ibid*., 346). We could say something similar. By allocating sex differences in abilities and motives to the parameters of linear models, we have created factor structures for the personality domains that apply to both sexes, so that we at least have a common language for describing all our adolescents. Nevertheless, typical performance for boys and for girls on our factors differ substantially. If we ever hoped to develop a theory of careers that would apply to both sexes, the experience of wrestling with the follow-up data has disabused us of the notion. As will be apparent to the reader who stays with us through Chapter Four, we may have made some progress toward a psychometric theory of male careers, but we have done very little with the problem of female career development, either empirically or theoretically. The Project TALENT girls, in their development toward womanhood, are a challenge we haven't really met.

The Generalizability of TALENT Results

The Retest Study and Twins Study evidence that has been discussed bears on the etiology and stability of the ability factors. Cooley (1967) has dealt with the development of interests in the Retest Study data in a separate monograph, and Schoenfeldt is preparing a Twins Study monograph that will report heritability indices for the motive factors. Actually, Project TALENT, which was designed to collect information about the consequences over time of personality status at a single point in time, is not in a good position to study the development of the personality traits measured by its battery. Another design, which provides for periodic measurement (say, every two years) over the entire span from childhood to early or middle adulthood, is needed. New research of this sort on the MAP factors would require a fuller instrumentation for measuring subjects at many age levels than the present TALENT battery provides.

A program of school guidance based upon the results of TALENT research would require an expanded array of testing procedures. If the MAP factor rubrics are meaningful only as an organization of the measurement variance collected specifically by the Project TALENT battery, then our researched validities for the factors have no generalizability and we have failed in our effort to produce a body of psychometric standards for career criteria to which other research can be keyed and which can be incorporated in guidance practice. Our contention is that the major MAP abilities and motives factors are suitable rubrics for organizing the main part of the measurement variance yielded by most educational measurement batteries for adolescence the testing industry provides today. The previous monograph on the MAP factors (Lohnes, 1966) is an effort to justify this expectation. We recognize the necessity for more concrete evidence for the proposition, and intend to engage in research in this direction in the immediate future. Meanwhile, we do have some evidence to report.

A special feature of the Project TALENT design was the administration of the 1960 battery to all the high school students in one county, both those in the probability sample and those who were not. For this special panel of youth, a great deal of additional testing and school records data was assembled, making it possible to correlate the TALENT measures with several well-known test batteries. Cooley and Miller (1965) and Cooley (1965) have reported canonical correlation studies on these data which show substantial overlaps of the TALENT battery with the Differential Aptitude Tests (DAT), the General Aptitude Test Battery (GATB), and the Flanagan Aptitude Classification Tests (FACT). For example, the first canonical correlation between the FACT and TALENT batteries was found to be .92, with other large canonical correlations between composites of these batteries. We have now done multiple correlation studies between the MAP abilities factors and the DAT, GATB, FACT, and the EHSCB (Essential High School Content Battery), using the 561 Knox County file subjects for whom we have complete data. Our primary interest in these studies is to demonstrate the possibility of getting useful estimates of the major MAP abilities factors from the best composites of these popular batteries. Table 1.10 arrays the multiple correlations achieved from each of the four predictor batteries. We think that these results suggest that a series of equating studies involving a representative group of commercial batteries and a suitable sample of subjects would establish acceptable alternative procedures for scaling the MAP abilities factors, and we believe that similar studies involving commercial inventories would do the same for the MAP motives factors. Table 1.11 is included to demonstrate that the highest bivariate correlations between MAP factors and external tests, in this case the eight DAT scales, occur in sensible places.

Estimates of MAP factors derived from replacement tests and inventories would not be uncorrelated. We believe that the virtues of uncorrelated factors as measurement rubrics outweigh the vices, as has been argued elsewhere (Lohnes, 1966, Ch. 1), but we concede that the features of the matrix of compounding coefficients that make it possible for the factors to be orthogonal also produce some practical problems. While all the important loadings in both the abilities factor pattern and the motives factor pattern are

Table 1.10: Multiple Correlations of MAP Abilities Factors Regressed on Four Different Abilities Batteries (561 Subjects).

MAP Abilities	DAT (8 scales)	GATB (12 scales)	FACT (17 scales)	EHSCB (11 scales)
VKN	.66	.70	.76	.78
ENG	.76	.63	.75	.70
MAT	.70	.66	.76	.74
VIS	.77	.65	.73	.55
PSA	.48	.45	.53	.30
MEM	.47	.35	.49	.37
H-F	.65	.54	.62	.50

Table 1.11: Bivariate Correlations between Each of 8 DAT Scales and 6 MAP Abilities Factors (561 Subjects)

Differential Aptitude Tests	MAP Factors						
	VKN	ENG	MAT	VIS	PSA	H-F	
Verbal Reasoning	.60	.22	.31	.21	-.08	.02	
Numerical Ability	.40	.11	.57	.32	-.01	.14	
Abstract Reasoning	.33	.16	.32	.39	-.03	-.01	
Space Relations	.23	-.01	.34	.57	-.06	.05	05
Mechanical Reasoning	.40	-.41	.56	.66	-.17	.52	
Clerical Speed and Accuracy	-.05	.33	-.10	-.09	.44	-.24	
Spelling	.30	.54	.02	-.24	.07	-.16	
Sentences	.43	.47	.14	-.01	-.02	-.17	

positive (important meaning $|a_{jk}| > .35$), the orthogonal linear functions defined by the beta weights are necessarily difference functions, and they suffer therefore in simplicity and reliability. Orthogonality has to be purchased at a price that some may not care to pay. We have examined the question of how well the MAP abilities factors can be estimated from simple functions of subsets of predictors, chosen from the TALENT battery in the light of the highest loadings of the factors. We have not used any of the 22 scales of the Information Part II portion of the battery, which we know are highly redundant on the 15 scales of Information Part I, so that we might see the effects of reducing the abilities battery from 60 tests to 38 tests. Also, we have not used four of the Information Part I scales, so the scheme we report actually requires 34 scales as the basis for estimates of six factors. An additional rule for the sake of simplicity is that each scale is employed in the scoring of one and only one factor.

Table 1.12 summarizies a series of multiple regression studies run to show how well each of five factors can be estimated from such a subset of predictors. The obtained multiple correlations make it clear that these new, simpler functions are only moderately similar to the MAP factors they might replace. Table 1.13 carries the simplification strategy a step further by suggesting a set of "PLAN A Factors" which would be produced by applying unit weights to standard scores on the indicators listed for each factor. That these new factors would be oblique to each other is indicated by the entries of Table 1.14. The computations of Table 1.12 and 1.14 are based on the intercorrelations among the 60 indicators as they were estimated for the original MAP factoring.

In this chapter we have reviewed a measurement theory for describing adolescent personality in its educationally-relevant traits, and have discussed some evidence on the etiology and stability of the traits and some technical aspects of making them operational. The next three chapters report the predictive validities we have been able to establish for the traits against follow-up studies

Table 1.12: Multiple Regressions of MAP Factors VKN, ENG, MAT
VIS, and PSA on Subsets of Their
TALENT Battery Indicators

I. Verbal Knowledges (VKN) from nine predictors: multiple R = .78

Predictor (p)		B	$r_{p,VKN}$
R102	Vocabulary	.06	.84
R103	Literature	.16	.88
R104	Music	.16	.83
R105	Social Studies	.19	.89
R108	Biological Sciences	.00	.65
R109	Scientific Attitude	-.01	.60
R110	Aeronautics	.10	.64
R111	Electricity and Electronics	-.05	.47
R115	Sports	.00	.61

II. English Language (ENG) from five predictors: multiple R = .74

Predictor (p)		B	$r_{p,ENG}$
R231	Spelling	.13	.79
R232	Capitalization	.19	.84
R233	Punctuation	.07	.82
R234	Usage	.10	.79
R235	Expression	.07	.72

Table 1.12 (continued)

III. Mathematics (MAT) from five predictors: multiple R = .77

Predictor (p)		B	$r_{p,VKN}$
R106	Mathematics Info.	.14	.81
R107	Physical Sciences	.00	.55
R311	Arithmetic Reasoning	-.07	.45
R312	Intro. Mathematics	.19	.79
R333	Advanced Mathematics	.35	.92

IV. Visual Reasoning (VIS) from four predictors: multiple R = .80

Predictor (p)		B	$r_{p,VIS}$
R270	Mechanical Reasoning	.07	.74
R281	Visualization in Two Dim.	.19	.78
R282	Visualization in Three Dim.	.30	.89
R290	Abstract Reasoning	.09	.71

V. Perceptual Speed and Accuracy (PSA) from three predictors: multiple R = .90

Predictor (p)		B	$r_{p,PSA}$
R420	Table Reading	.24	.79
R430	Clerical Checking	.35	.85
R440	Object Inspection	.21	.75

Table 1.13: PLAN A Factors and Their TALENT Tests (unit weights for z scores)

1. VKN: Verbal Knowledges (from 11 tests)

R102	VOC	Vocabulary
R103	LIT	Literature
R104	MUS	Music
R105	SST	Social Studies
R108	BIO	Biological Sciences
R109	SCA	Scientific Attitude
R110	AER	Aeronautics and Space
R111	ELE	Electricity and Electronics
R115	SPO	Sports
R250	RDG	Reading
R260	CRE	Creativity

2. ENG: English Language (7 tests)

R220	DSW	Disguised Words
R231	SPL	Spelling
R232	CAP	Capitalization
R233	PNC	Punctuation
R234	USG	English Usage
R235	EXP	Effective Expression
R240	WDF	Word Functions in Sentences

3. MAT: Mathematics (5 tests)

R106	MAT	Mathematics Information
R107	PHY	Physical Sciences
R311	ARR	Arithmetic Reasoning
R312	MA9	Introductory Mathematics
R333	ADV	Advanced Mathematics

4. VIS: Visual Reasoning (4 tests)

R270	MCR	Mechanical Reasoning
R281	VS2	Visualization in Two Dimensions
R282	VS3	Visualization in Three Dimensions
R290	ABS	Abstract Reasoning

5. PSA: Perceptual Speed and Accuracy (5 tests)

R410	ARC	Arithmetic Computation
R420	TBL	Table Reading
R430	CLR	Clerical Checking
R440	OBJ	Object Inspection
A500	PRF	Preferences

6. MEM: Memory (2 tests)

R211	MMS	Memory for Sentences
R212	MMW	Memory for Words

Table 1.14: Intercorrelations of PLAN A Factors

PLAN A Factor	VKN	ENG	MAT	VIS	PSA	MEM
VKN	1.00	.75	.79	.64	.23	.46
ENG		1.00	.70	.58	.30	.50
MAT			1.00	.61	.22	.45
VIS				1.00	.27	.37
PSA					1.00	.22
MEM						1.00

criteria in the areas of educational and vocational adjustments and career development. These prediction studies were accomplished by computing the 22 MAP factor scores for each of the individuals included following the procedures outlined in the original MAP report (Lohnes, 1966, pgs. 2-15 to 2-17). In addition, factors were scaled so that within a particular grade and sex, factor scores have a mean of 50 and a standard deviation of 10. The final chapter attempts to bring all the generalizations together and to bring them to bear on the problem of career guidance.

CHAPTER II

Predicting Educational Adjustments

The objectives of education are usually stated in terms of gains to be created in certain personality traits, whether abilities or motives, possessed by the students. A primary purpose of educational measurement has always been the appraisal of the actual changes in personality traits of students that occur over instructional periods. The classic design in educational research requires testing students before an instructional unit, providing the "treatment," and testing again after the instructional unit, so that gain scores may be computed. Another group of students receives the same pre- and post-tests with a different intervening "treatment," so that the effects of the experimental and control treatments can be compared. If the students have been randomly assigned to the treatments, statistical analysis provides guides to reliable inferences about the differences in treatment effects. Thus, one kind of educational research which could be done in the framework of the MAP factors would be experiments to discover the effects of various educational treatments on students' factor scores. True experiments of suitable scope and rigor represent the most appropriate empiricism for a science of instruction, or of human learning, but there is another way in which useful information about effects of different educational treatments can be garnered.

A second kind of research into educational effects of MAP factors involves surveying the distributions of factor scores in representative groups of students who have experienced different educational treatments. Unfortunately, survey subjects will not have been randomly assigned to treatments. Recruitment to different treatment groups that can be surveyed will probably have been contingent on personality factors in the first place. It is very crucial to a proper appreciation of the roles of experiments and surveys in educational research to hold firmly in mind that, while experiments can gauge the effects of treatments per se, surveys can only gauge the combined effects of recruitment-treatment combinations. Nevertheless, information about the effects of different recruitment-treatment programs can also be useful, and in studies of some phenomena, is all that is possible. Although only proper experiments can reveal precisely what different educational procedures can accomplish with students, good surveys can reveal what is happening to students in the variety of programs run within our schools.

An example of a recent effort to survey the effects of different recruitment-treatment combinations in public education is Coleman's (Equality of Educational Opportunity, 1966) inquiry into the effects of degrees of racial segregation in schools on the abilities of young people. Some 600,000 students and 60,000 teachers in 4,000 schools provided data for the Coleman report. The students who were in grades 1, 3, 6, 9, and 12, took a variety of ability tests and a questionnaire. The survey results confirm that segregation of minority groups is the de facto rule in our schools, and show the extent of substandard test performance by minority groups.

> With some exceptions - notably Oriental Americans - the average minority pupil scores distinctly lower on these tests at every level than the average white pupil. The minority pupils' scores are as much as one standard deviation below the majority pupils' scores in the 1st grade. At the 12th grade, results of tests in the same verbal and nonverbal skills show that, in every case, the minority scores are farther below the majority than are the 1st graders. (21)

The facts of segregation and poor performance of the segregated are clear in the survey. Less clear are the reasons why poor performance prevails in minority groups. The detailed analyses of the report seem to suggest that recruitment into different groups from different sources has much more to do with establishing performance differences than does differential treatment after recruitment. The implication is that general social circumstances are far more potent in shaping performances than are specific school variables. One thing the study does reveal clearly is that individual differences *within* groups are far larger than differences *among* groups, which reminds us again that each student must be viewed and treated as an individual, for what *he* is, what *he* needs, and what *he* can do.

The High School Years

In Chapter One we reviewed a few of the results of a Project TALENT Retest Study, in which a part of the ninth-grade sample was retested in the twelfth grade. We presumed that the observed changes in test performances over three years for these students were in part a result of their experiences in high school. The single change variable defined on the MAP ability factors was a function of Verbal Knowledges and English Language, which showed some tendency to change concomitantly. Otherwise the evidence seemed to show that change in any one factor was not related to changes in other factors. We interpreted this result as reinforcing the notion that the core of general educational achievement in our culture is composed of the behaviors measured by the MAP factors of Verbal Knowledges and English Language. The Retest Study did not throw light on what school variables influence this change variable, although such research would be very desirable.

One study of differential recruitment-treatment effects in terms of the MAP factor rubrics has been done by Williams (1967), who compared the complete MAP factor centroids of several twelfth-grade curriculum groups, separately for males and females. Since his subjects were tested in the twelfth-grade, the curriculum group means can be seen as descriptions of how the products of the various curricula differ as they approach graduation. The results do not show the differential *productivity* of the curricula, since another study, reported below, reveals that the curriculum groups as tested in the ninth grade differ in ways that prefigure the twelfth-grade differences. Product differences shown by Williams' study are due to recruitment *and* treatment differences to unknown extents. Williams worked with a random ten percent of the TALENT twelfth-grade data file. Table 21 displays his group sample sizes. He computed discriminant analyses separately for each sex. Besides the 22 MAP factors he employed as a 23rd predictor a socioeconomic environment (SEE) scale.

Table 2.1: Twelfth-Grade Curricula and Sample Sizes (Williams, 1967, 9)

Mnemonic	Curriculum	Males	Females
COL	College Preparatory	1606	1405
BUS	Commercial or Business	224	1253
GEN	General	839	636
VOC	Vocational	416	103
AGR	Agriculture	134	None
	Totals	3219	3397

Williams found that one discriminant function described most of the separation among groups, and on that function the big separation is of the College Preparatory group from the others. Figure 2.1 shows this graphically. Table 2.2 gives male and female means for the groups on the most useful predictors. It should be noted that in these studies there is criterion contamination in the Schoasticism (SCH) factor, since High School Curriculum is one of the six indicators for the factor. Socioeconomic Status (SEE) emerges as a fairly good predictor, as we would expect. All the boys' groups are poor performers on English Language (ENG), whereas all the girls' groups are below average on Mathematics. The systematic sex differences on all the factors have been accounted for elsewhere as constants in a linear model (Lohnes, 1966, Ch. 7). The loadings of the predictors on the discriminant function, reported in Table 2.3, encourage us to name the function Science-oriented Scholasticism. In Chapters Three and Four we report very similar first discriminants for our studies of career and occupational criteria. The general concept of a dimension in the MAP factors space oriented primarily by the motives of Scholasticism and Science Interests and the abilities of Mathematics and Verbal Knowledges, and referred to as Science-oriented Scholasticism, emerges as the major explanatory and predictive personality function in our theory of the antecedents of adult development.

In the convention of multiple group discriminant analysis we have termed the MAP factors plus SEE the "predictors" in discussing Williams' twelfth-grade curriculum studies. Actually, he viewed curriculum group as the independent variable and the 23 MAP + SEE scales as the dependent

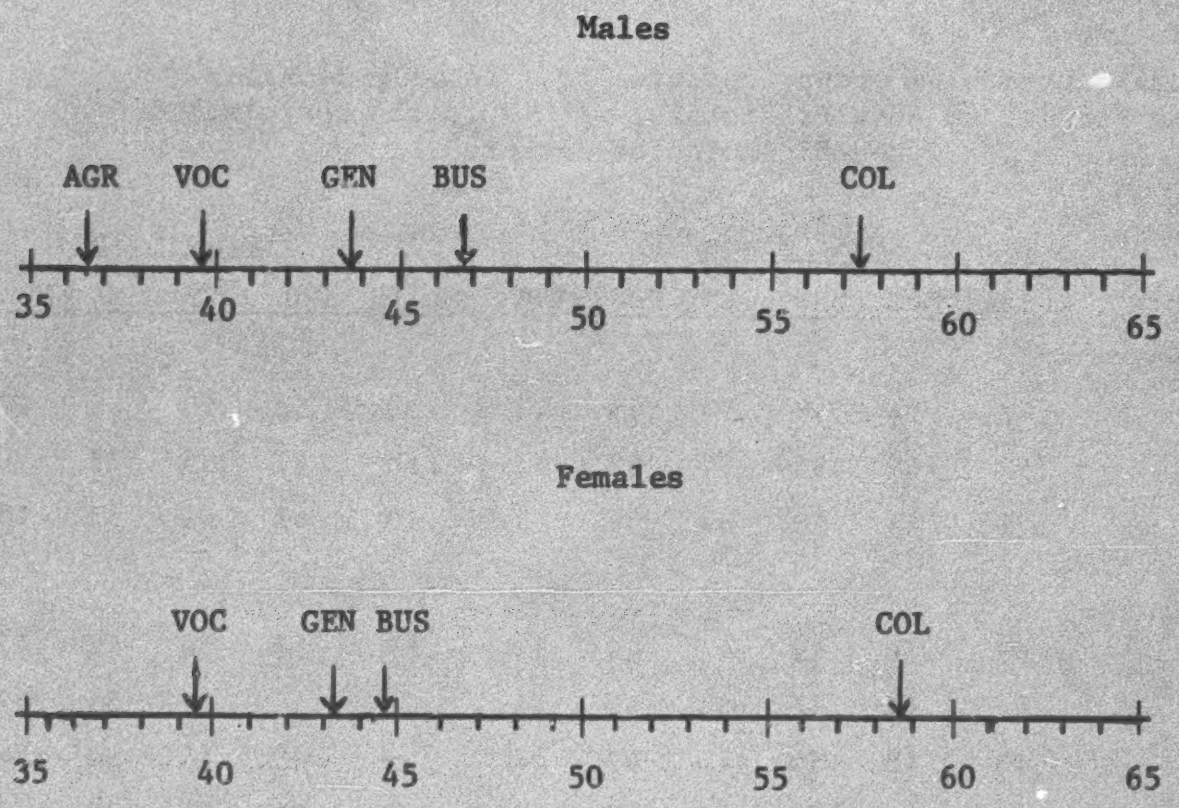

Figure 2.1. Twelfth-grade curriculum group means for males and females on first discriminant function

Note:

In this report we have scaled both the MAP factors and the discriminant scores so that within a grade-sex cell, the factors and functions have a mean of 50 and a standard deviation of 10.

Table 2.2: Curriculum Group Centroids for 12th-Grade Males and Females on Best Predictors, with Multiple Correlation Coefficients for Factors

	Male Means						Female Means				
Predictors	**MultR**	**COL**	**BUS**	**GEN**	**VOC**	**AGR**	**MultR**	**COL**	**BUS**	**GEN**	**VOC**
Abilities											
VKN	.42	56	48	50	45	43	.39	52	45	45	40
MAT	.52	68	53	54	52	53	.50	47	35	37	38
ENG	.21	41	40	39	36	35	.19	61	61	57	54
Motives											
SCH	.67	56	49	47	44	43	.62	58	50	47	45
SCI	.47	67	57	58	56	54	.43	44	34	36	37
BUS	.15	48	54	47	47	47	.29	49	55	50	54
OUT	.32	60	62	66	68	72	.12	38	35	38	37
CUL	.07	39	38	38	37	36	.23	64	59	62	59
CON	.17	47	44	43	43	43	.12	55	55	52	52
ACT	.18	51	52	52	55	57	.09	46	47	48	50
LEA	.18	51	49	48	47	53	.24	53	47	49	48
INT	.18	53	54	51	49	48	.10	48	49	47	44
Status											
SEE	.39	53	46	46	44	44	.41	54	46	46	43

variables in his studies, which makes sense if we take these as studies of the effects on personality traits of recruitment-treatment combinations (although the role of the SEE scale is ambiguous). In all the new research relating the MAP factors to adult development reported in this monograph, the authors have employed the personality measures as antecedent, independent, predictor variables and have employed temporally concurrent or (usually) posterior categorical membership variables as consequent, dependent, criterion measures. Most of our criterion variables represent educational or vocational adjustments, which we refer to collectively as career adjustments. An example of this research paradigm is provided by a discriminant study we conducted of curriculum of graduation in the space of MAP factors + SEE measured in ninth grade. All the subjects are males from the one-year follow-up study file, so that the curricula in which they graduated from high school are available. In this study the criterion is posterior to the predictors by four years. Table 2.4 reports group centroids on the best predictors, and Table 2.5 describes the best discriminant function. Figure 2.2, when compared with Figure 2.1, shows that the male curriculum groups are not as well separated in the 9th-grade measurement space as they are in the 12th-grade space, and also that Business and General groups appear to exchange positions over the four years of high school. The general similarity in results of this study of senior year groups in 9th-grade measurement space with Williams' study of the same groups (different subjects) in 12th-grade measurement space justifies the assumption that recruitment practices influence survey groups separation, while the differences in detail of the studies justify the assumption that treatment effects also exist, in combination with recruitment effects.

The style of research which employs multiple group discriminant analysis to predict educational adjustments from personality traits was initiated by Tiedeman and Sternberg (1952). These authors predicted a binary curriculum variable (0 = Business; 1 = College Preparatory) from ninth-grade scores of 207 students on the eight scales of the Differential Aptitude Test. Although the single discriminant function for their two groups could have been computed by regression analysis, the authors argued

2

Table 2.4: Curriculum Group Centroids for 9th-Grade on Best Predictors, with Multiple Regression Coefficients for Factors

		Curriculum Groups			
		COL	BUS	GEN	VOC
	Sample Size:	3407	268	1417	225
Predictors	MultR				
Abilities					
VKN	.40	56	47	48	47
MAT	.20	54	51	51	51
ENG	.22	48	44	44	41
Motives					
SCH	.37	53	48	48	48
SCI	.33	60	54	54	53
BUS	.11	49	51	47	46
OUT	.18	54	56	58	60
CON	.22	50	47	46	45
ACT	.14	48	51	50	52
Status					
SEE	.34	53	46	46	43

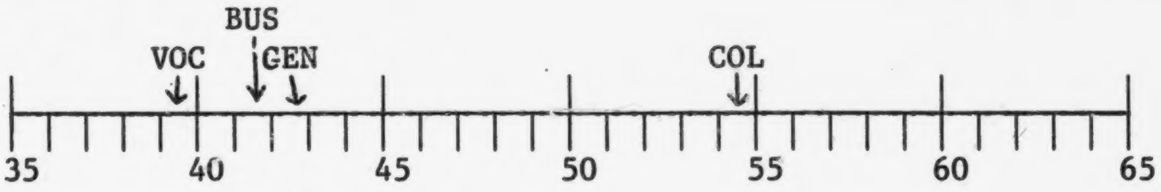

Figure 2.2. Ninth-grade curriculum group means for males on first discriminant function

Table 2.5: Factor-Discriminant Function Correlations and Canonical R Correlation for 9th-Grade Male Curriculum Study

	DFI
Canonical r	.61
Predictors	
Abilities	
VKN	.66
MAT	.33
ENG	.35
VIS	.10
PSA	.07
MEM	-.03
H-F	-.05
COL	-.06
ETI	.01
SCR	.01
GAM	.10
Motives	
SCH	.60
SCI	.54
BUS	.09
OUT	-.29
CUL	.10
CON	.36
ACT	-.23
LEA	.06
INT	.02
IMP	-.18
SOC	-.05
Status	
SEE	.56

DFI: Science-oriented Scholasticism

persuasively that for multiple groups the discriminant analysis (quite new at that time) would provide information describing group memberships that is most appropriate for guidance and that regression cannot provide. They also exposited centour scores as a means of displaying probabilities of membership in each group to a counselee, and computed centour values of discriminant scores for their subjects. In this they applied to a guidance problem the insight of Rulon's fable of "The Stanine and the Separile" (Rulon, 1951a). Tiedeman, Rulon and Bryan (1951) had already demonstrated the utility of the new technique in classification of airmen to eight specialties, and both Tiedeman (1951) and Rulon (1951b) had stated the uses of discriminant analysis in general terms. Nevertheless, the 1952 paper by Tiedeman and Sternberg deserves status as a classic in the history of guidance for its explicit demonstration of a new and powerful methodology that is uniquely appropriate for the guidance research problem. Two years later Tiedeman and Bryan (1954) were to emphasize the point with a demonstration of discriminant analysis applied to the prediction of college fields of concentration. Many researchers in education have followed the lead of these Harvard studies in the fifteen years since, so that the new methodology has become firmly established. An interesting example is provided by Hummel and Sprinthall (1965), who were able to discriminate types of underachievers in a measurement space involving interests, attitudes, and values. Lohnes and McIntire (1967) recently argued that statewide testing programs could apply discriminant analysis to provide "classification validities" as a score interpretation service, and demonstrated that state norms could be as good as local norms for curriculum guidance with data from a statewide 10th-grade testing program. In Chapter Five we describe how we think Tiedeman's vision of "information appropriate for guidance" can be realized by a computer measurement system in schools that taps the research findings of Project TALENT's discriminant studies.

A study of the question of who drops out of high school using the TALENT grade 9 males is reported in detail elsewhere (Combs & Cooley, 1967). The salient features of that study for the validation of the MAP factors measurement model are reported in Table 2.6. The predictive validity of the factors for the dropout males versus male high school graduates who do not seek further education is quite weak, although real, but the details

Table 2.6. Discriminant Analyses of High School Male Dropouts versus High-School Graduates Who Do Not Seek Further Education, in the 9th-Grade MAP Factor Domains

I. Abilities domain study

A. Means on best predictors.

Factor	Rank	Correlation	Dropouts (N=1496)	Graduates (N=1534)
VKN	3	.14	49	51
ENG	1	.23	36	41
SCR	2	.17	50	54

B. Canonical R = .32; 63% correct classifications.

[In space of 60 indicator tests, Canonical R = .39; 66% correct classifications.]

II. Motives domain study

A. Means on best predictors.

Factor	Rank	Correlation	Dropouts	Graduates
IMP	1	.21	56	52
ACT	2	.17	57	53
SCI	3	.14	57	60

B. Canonical R = .33; 64% correct classifications.

[In space of 38 indicator scales, Canonical R = .41; 67% correct classifications.]

are interesting. English Language ability emerges as the leading ability deficiency of ninth-grade boys who will become dropouts. In the motives domain, high Impulsion scores characterize the dropout group. The suggested view of the school dropout as a boy who murders the language and doesn't care to refrain from acting out in annoying ways is convincing. It should be noted that as part of this investigation classification statistics were computed in both the MAP factors space and in the full space of the original indicators for each domain allowing a comparison of classification efficiency of full-rank and reduced-rank models. In both domains the reduced-rank MAP factors model comes very close to matching in hit rate the full-rank model.

The College Years

There has been a wealth of research on the prediction of college adjustments from trait measures. Several major organizations have been concentrating on this area. The American Council on Education has reported on trait characteristics of junior college students (Panos, 1966), documenting "the relative gap that exists between two-year and four-year institutions with regard to a variety of student input characteristics and academic achievements." Other A.C.E. reports have concerned "National Norms for Entering College Freshmen - Fall 1966" (Astin, Panos, Creager, 1967), which tabulated student self-reports on a variety of personality traits by college of choice, and "Trends in the Characteristics of Entering College Students, 1961-1965" (Astin, 1966), which reached these three generalizations:

> 1. Differences among institutions in most student input characteristics are highly stable over an interval of four years.
> 2. There is no clear evidence...either that the institutions are becoming increasingly selective as a group or that the gaps among institutions in relative selectivity are widening. However, those students who have published original writing prior to entering college seem to be increasingly concentrated in the more selective institutions.
> 3. Several major changes in the educational and career plans of entering freshmen have occurred during the

> past four years. These trends may have important implications for educational policy, guidance and counseling, and manpower planning. (Astin, 1966, 7)

The trends mentioned in point 3 include a drop in percentages planning to enter education and engineering, and a sharp rise in percentage planning graduate study.

The National Merit Scholarship Corporation has also reported on "Career Changes in College" (Werts, 1966b):

> The results support the generalization that in terms of academic ability and social class background, students who are unlike the majority of the other students with the same initial career choice tend to change their career plans to another field where they will be more like the other students. Other results suggested that sons who chose the same occupations as their fathers were less likely to change their career plans than others making those career choices.

N.M.S.C. has also reported on "Sex Differences in College Attendance" (Werts, 1966a), showing that among low ability and/or low socioeconomic status students, boys are much more likely to enter college than girls; and on "College Preferences of Eleventh Grade Students" (Nichols, 1966), with these conclusions:

> High ability students were attracted by affluent colleges and institutions where the environment is described as high in awareness and scholarship. Low ability students tended to be attracted by colleges with low tuition and colleges with environments characterized as high in practicality.

Research on N.M.S.C. data led Holland to formulate a theory of types of personality orientations and matching types of college environments (Holland; 1962, 1963). His six types are:

Realistic
Intellectual
Social
Conventional
Enterprising
Artistic.

Each type, or model orientation, "is a theoretical complex consisting of coping mechanisms, personal traits, vocational and educational goals, life histories, aptitudes, and other attributes" (Holland, 1962, 1). Subjects in Hollands's researches are assigned to a type on the basis of interest inventory response keys (Holland, 1958), then the other values of the complex for each type are discovered empirically. Holland does not choose to employ powerful statistical analyses, with the result that his masses of data are rather ill-digested, but he does marshal consistent if weak evidence for his major generalization, which he states as follows:

> Students with different dominant personal orientations (defined by coded scales from a vocational preference inventory) have significantly different attributes, including academic aptitudes, fathers' occupations, self-concepts, extracurricular activities and interests, college majors, career choices, achievements, and parental attitudes and values. (Holland, 1962, 48)

Holland's theory holds that a person requires an environment which matches his personal orientation if he is to be productive. He has some evidence that college environments can be typed by his scheme and that different types of environment sponsor different reactions in students. One of his studies of National Merit Finalists supports the following generalization about college major fields:

> Remaining in a given field appears to be associated with having personal attributes commonly associated with the typical student while leaving a field is related to dissimilarity between a student's attributes and those of the typical student. (Holland & Nichols, 1964, 235)

This is the same result as reported by Werts in the study quoted above. In Chapter Four we review substantial Project TALENT evidence along this line, and in Chapter Five we hazard the statement of a probability law governing career changes and career stabilization.

Astin chose to approach the relation of student personality to college environment with a dimensional model rather than a typal model. The reader will not be surprised to learn that we view Astin's approach with considerably more enthusiasm than we can muster for Holland's approach. The dimensional model naturally leads Astin to a multivariate statistical approach, that of factor analysis, to his data. In a book titled Who Goes Where to College?, Astin (1965) presents six factors to account for the intercorrelations among 52 indicators of student characteristics. The factors were produced by varimax rotation of principal components, much as our MAP factors were. Astin's factor names are:

Intellectualism
Estheticism
Status
Leadership
Pragmatism
Masculinity.

Thus, where Holland assigns a student to one of six types, Astin assigns the student a score profile with six scale scores. We are convinced that the latter conveys a more reasonable amount of information about the student. Astin also invented a scheme for scoring colleges on his six variables, and another scheme for estimating scores for colleges from incomplete indicators. He has a table of estimated scores for 1015 colleges.

In addition to estimates for five of his six factors, Astin reported a Selectivity scale score and six Orientation scale scores for 1015 colleges and universities (Astin, 1965, Table 13, 57-83). He has made these scores available on an IBM card deck to expedite their use by other researchers. The Orientation scale scores are based on proportions of baccalaureate degrees awarded in various fields by the institution in 1961 (Astin & Holland, 1961), and in name are close to Holland's six types. Obviously, the Astin factors are considerably correlated with these additional six measures.

In an effort to relate a taxonomy of colleges based on commonplace considerations of size, type of control, and type of instruction to Astin's dimensions of college environment, we have defined seven categories of institutions (Table 2.7). Using data on institutional characteristics acquired from the Columbia University data bank on colleges, we have assigned 994 of Astin's 1015 colleges to our cells. Analysis of variance methods indicate very strong relationships between the Astin dimensions and the ordinary language categories. Centroids and F-ratios for the seven groups on the 12 variables are reported in Table 2.8, in our usual scale convention in which the grand mean is 50 and the total sample standard deviation is 10. Three useful discriminant functions separate the seven college groups. The loadings of the variables on the functions are given in Table 2.9, and the centroids of the groups in Table 2.10. The first function is, as would be expected, an Intellectualism one, and

Table 2.7: Categories of Four-Year Higher Education Institutions Based on Size, Control and Instruction (Total N=994 Colleges)

I Private nonsectarian with less than 10 percent graduate enrollment (N = 101).

II Private nonsectarian with 10 percent or more graduate enrollment and sectarian with total enrollment of 2,000 or more and 10 percent or more graduate enrollment (N = 100).

III Sectarian with less than 2,000 total enrollment and no graduate enrollment (N = 313).

IV All sectarian institutions not in II or III (N = 152).

V Public with no graduate enrollment and public with less than 2,000 total enrollment and less than 10 percent graduate enrollment (N = 110).

VI Public with total enrollment less than 2,000 and 10 percent or more graduate enrollment and public with more than 2,000 total enrollment and less than 10 percent graduate enrollment (N = 103).

VII Public with total enrollment of 2,000 or more and 10 percent or more graduate enrollment (N = 115).

Table 2.8: Centroids and F-ratios for Seven College Groups on Twelve Astin Variables

	College Groups							
Variables	I	II	III	IV	V	VI	VII	F-ratio*
Intellectualism	59	60	48	49	42	44	50	65
Estheticism	59	52	50	48	46	46	49	23
Status	61	57	50	51	42	45	48	63
Pragmatism	48	56	47	49	47	51	57	29
Masculinity	51	59	47	53	45	48	51	31
Selectivity	54	60	49	51	42	45	52	55
Realistic	47	53	47	47	51	54	58	27
Scientific	51	52	52	49	46	49	50	6
Social	45	42	52	52	57	53	48	35
Conventional	49	57	49	52	44	49	54	21
Enterprising	53	55	51	54	41	45	48	36
Artistic	54	46	52	48	53	50	48	12

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*Number of degrees of freedom are 6 and 987. All are significant at the .001 level.

Table 2.9: Predictor-Discriminant Function Correlations for Study of Seven College Groups, with Canonical Correlations of Discriminant Functions with Group Variate Functions

	DFI	DFII	DFIII
Canonical Correlation	.73	.56	.51
Variables			
Intellectualism	.72	-.06	-.04
Estheticism	.35	-.28	-.26
Status	.65	-.34	-.14
Pragmatism	.23	.55	.27
Masculinity	.46	.15	.28
Selectivity	.65	-.02	.28
Realistic	.03	.65	.05
Scientific	.13	-.17	.11
Social	-.56	-.07	-.04
Conventional	.32	.19	.41
Enterprising	.43	-.36	.39
Artistic	-.12	-.26	-.34

DFI extracts 19.8% of battery variance.

DFII extracts 10.1% of battery variance.

DFIII extracts 6.3% of battery variance.

Table 2.10: Centroids in Three-Dimensional Discriminant Space for Seven College Groups

College Groups	DFI	DFII	DFIII
I	61	46	39
II	65	55	53
III	47	44	52
IV	51	48	55
V	40	54	43
VI	43	56	47
VII	51	60	54

private universities are highest on it. The second function is oriented by Pragmatism and Realistic Orientation, and large public universities are highest on it. The third function is a Business one, and private nonsectarian colleges are extremely low on it. This all seems to make a good deal of sense.

In another study involving Astin's college data, we attached a vector of Astin's twelve variables to the MAP factor scores for each of 4421 males in our 5-year follow-up file (high school class of 1960), depending upon which college they had graduated from. Thus each male in this sample had twelve Astin scores and 22 MAP scores. A canonical correlation analysis between these two sets of data revealed several independent dimensions in the Astin data which are highly correlated with independent combinations of the MAP factors. The three largest canonical relationships are summarized in Table 2.10A. These and other studies have convinced us that colleges and their students co-vary in important ways, and these ways need to be further defined if we are to make significant improvements in our understanding of how higher education is operating in this country. Project TALENT together with the Astin ACE and Columbia University data banks provide a very valuable data base for such investigations.

The American College Testing Program is another organization that has been active in research on adjustments in higher education. For example, Abe and Holland (1965) reported personality descriptions of freshmen with different choices of major field, based on a 1004-item self-report questionnaire. For each major field they tabled the names of the variables for which the sample group had lowest and highest means, without numerical values. The unwillingness of these authors to employ any type of multivariate analysis on data in which individual subjects and criterion groups are characterized by long vector variables is unfortunate, since a reduction of the data should prove useful. The authors do give a table of univariate F-ratios for 108 scales across 79 male and 60 female fields, from which they derive their strongest generalization, as follows:

> If the size of the F ratio is used as an index of the most discriminating variables, then the interest and life goals variables are generally most useful for the characterization of students in different major fields.

Table 2.10A: Canonical Relationships Between Astin Dimensions and MAP Factors (N=4421 Male Students)

1st Canonical
R = .58

High Loadings

Astin	
Selectivity	.94
Intellectualism	.80
Status	.58

MAP	
MAT	.74
VKN	.50

2nd Canonical
R = .33

High Loadings

Astin	
Realistic	.74
Scientific	.53
Pragmatism	.49

MAP	
H-F	.59
VIS	.55
OUT	.44

3rd Canonical
R = .26

High Loadings

Astin	
Masculinity	.62
Pragmatism	.50
Conventional	.42
vs.	
Artistic	-.84
Social	-.56
Estheticism	-.44

MAP	
SCI	.31
OUT	.30
vs.	
CUL	-.50
SOC	-.39
COL	-.32

> If we consider different kinds of content rather than kinds of assessment devices, we find that variables of scientific, artistic, and business content are most discriminating. (Abe & Holland, 1965, 49)

We submit that a better way to determine the most discriminating variables is to compute a multiple group discriminant analysis. First, however, there is a criterion problem to be surmounted. It does not make sense to do even univariate F-ratios across 60 or 79 cells. A meaningful and discriminable taxonomy of major fields is essential. The authors realize this, as their last paragraph states:

> In new studies, we plan to develop psychological classification schemes which will be useful for practice and research. The current conventional classifications lack psychological homogeneity so that membership in a group frequently has diffuse and even conflicting meaning. (Abe & Holland, 1965, 51)

With this we are in perfect agreement. The major thrust of our recent work has been toward the reduction of this problem as will be seen in Chapter Four.

Another A.C.T. product is a book of College Student Profiles (Munday & Hoyt, 1966) which again seems to us to suffer from incomplete data reduction. The authors do seem to justify their conclusion, which they state as follows:

> This study reaffirms and clarifies the generally held contention that diversity characterizes American higher education. The results suggest that not only can a student find a college where he will closely resemble the average student, but he also can find students like himself at almost any type of institution in any geographical region. Thus, detailed normative information like that presented here can help broaden as well as narrow college choice exploration. (Munday & Hoyt, 1966)

In a study involving continuously distributed criteria of college achievement, both academic and nonacademic, the A.C.T. researchers have brought order out of a welter of data by use of multiple correlation analysis (Richards, Holland, Lutz, 1966). Their study demonstrates convincingly that nonacademic accomplishments in college can be predicted from scaled nonacademic performances in high school about as well as academic achievement in college can be predicted from academic performances in high school and on aptitude tests. They also show that the two classes of accomplishment are largely independent of each other.

From this evidence they argue eloquently for a theory of human talent that takes a broader view than some past theories of intelligence took, and for college recruitment and grading practices that recognize the importance of nonacademic accomplishments. This research report deserves the widest possible attention among educators, for its implications are virtually revolutionary.

Project TALENT has published some studies of post-high-school educational patterns and choice of college (Flanagan, et al., 1966, Chapters 5, 6). Perhaps the most striking result obtained is a comparison of junior college students, male and female, with noncollege and four-year college people, male and female (Cooley & Becker, 1966):

> There is a tendency for junior college students to be more like noncollege students in terms of ability, and slightly more like college students in terms of socioeconomic factors. This is true for both males and females.

Turning to new results on male college adjustments as predicted from the MAP factors, we have found choice of major fields, dropping out of college, enrollment in a graduate school, and choice of graduate school major all significantly related to MAP profiles. Table 2.11 identifies 24 college major fields in which 12th-grade sample males reported they had graduated on the five-year follow-up. Table 2.12 gives the best predictors of college major field, with Mathematics ability and Cultural interests leading, and shows some reasonable outcomes. History majors are highest on Verbal Knowledges. Engineering, Mathematics, and Physical Science majors are highest on Mathematics ability. Engineering and Arts majors lead on Visual Reasoning, and suitable groups lead on the four interest areas. Agriculture and Education majors are lowest on Verbal Knowledges. The factor loadings reported in Table 2.13 seem to justify naming the two best discriminant functions Technical versus Sociocultural and Cultural versus Business and Social. Table 2.14 gives the group means on these two functions, and the groups are plotted in the best discriminant plane in Figure 2.3. The locations of the groups are quite sensible. Apparently twelfth-grade personality measures contain considerable information that prefigures college major field placements. On these and all the discriminant functions to be reported the abilities and motives factors work together to separate the criterion groups.

Table 2.11: Major Field Groups of College-Graduated Males from 12th-Grade 5-Year Follow-up

Mnemonic	Major Field	Sample Size
MATH	Mathematics	245
PHYS	Physical Sciences	323
BIOS	Biological Sciences	309
PSYC	Psychology	146
HIST	History	293
ECON	Economics	209
SOCS	Social Science	326
ENGL	English	250
FLNG	Foreign Language	51
ARTS	Arts	62
MUSI	Music	50
PHIL	Philosophy	117
RELG	Religion	30
PLAW	Pre-law	34
PMED	Pre-medicine	72
PDEN	Pre-dentistry	18
HEAL	Health	52
ENGI	Engineering	632
ELED	Elementary Education	58
PHED	Physical Education	109
EDUC	Secondary Education	122
ACCT	Accountant	293
BUSI	Business	554
AGRI	Agricultural	132
Total		4487

Table 2.12: **Major Field Group Centroids on Best Predictors, with Multiple Regression Coefficients for Factors**

Rank:	5	1	8	7	6	2	3	4
Factor:	VKN	MAT	VIS	BUS	OUT	CUL	SCI	SOC
MultR:	.35	.48	.30	.31	.31	.47	.39	.38
Major								
MATH	56	81	59	50	59	35	69	45
PHYS	61	81	59	45	61	38	72	43
BIOS	60	74	58	43	60	41	73	48
PSYC	61	73	56	46	56	45	69	49
HIST	64	69	53	48	56	45	65	50
ECON	61	74	55	50	57	40	68	51
SOCS	62	68	54	49	57	43	66	53
ENGL	63	70	55	46	55	50	62	49
FLNG	62	74	53	45	54	48	62	43
ARTS	60	61	61	44	56	54	59	49
MUSI	61	66	55	45	51	56	54	50
PHIL	62	69	55	47	57	46	65	42
RELG	58	67	55	48	59	42	60	50
PLAW	61	72	53	51	57	42	66	53
PMED	58	78	56	45	58	41	74	46
PDEN	54	76	60	46	62	37	73	51
HEAL	60	73	56	47	58	39	72	47
ENGI	58	82	62	46	63	34	71	44
ELED	54	60	56	49	61	43	62	53
PHED	54	62	52	48	63	35	64	58
EDUC	54	65	59	48	63	40	63	51
ACCT	57	72	55	54	58	33	67	51
BUSI	57	67	56	52	59	35	65	53
AGRI	52	68	59	44	70	34	64	47

Table 2.13: Factor-Discriminant Function Correlations for Major Fields of College-Graduate Males

Factor	DF1	DF2
Canonical Correlation	.59	.50
Abilities		
VKN	-.19	.57
PSA	.01	-.09
MAT	.73	.33
H-F	.23	-.11
ENG	-.13	.03
VIS	.43	.03
COL	-.15	.27
ETI	.01	-.10
MEM	.00	.06
SCR	.19	-.34
GAM	.13	-.05
Motives		
BUS	-.17	-.41
CON	-.02	.00
SCH	.30	.29
OUT	.33	-.28
CUL	-.54	.65
ACT	.09	-.09
IMP	-.16	.09
SCI	.55	.14
SOC	-.45	-.44
LEA	-.16	-.04
INT	-.00	.18

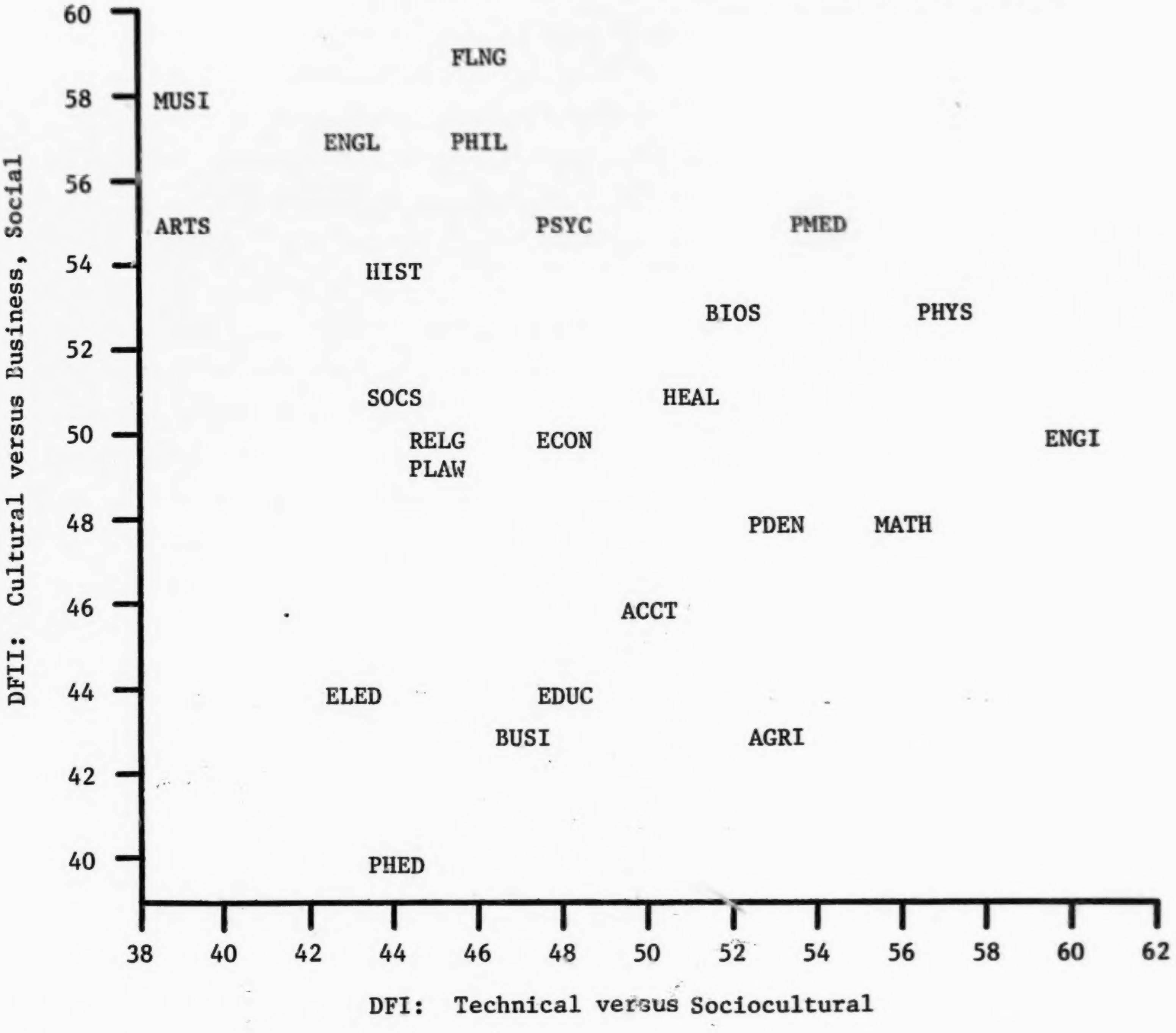
DF1: Technical versus Sociocultural

DF2: Cultural versus Business and Social

Table 2.14: Discriminant Function Centroids for 24 College Major Field Groups in Best Discriminant Plane of 12th-Grade MAP Space

Major	DF1	DFII
MATH	56	48
PHYS	57	54
BIOS	52	53
PSYC	48	55
HIST	44	54
ECON	48	50
SOCS	44	51
ENGL	43	57
FLNG	46	59
ARTS	39	55
MUSI	39	58
PHIL	46	57
RELG	45	50
PLAW	45	50
PMED	54	55
PDEN	53	48
HEAL	51	51
ENGI	60	50
ELED	43	44
PHED	44	40
EDUC	48	44
ACCT	50	46
BUSI	47	43
AGRI	53	43

Figure 2.3: Centroids of College Major Fields in Discriminant Plane (data in Table 2.14)



Given that a young man in our sample graduates with a baccalaureate degree from college, his decision to enroll in a graduate school or not is only slightly related to his 12th-grade measurement profile. The basis for the real but weak relationship that we do find is summarized in Table 2.15, which shows that the best predictors are Mathematics, Verbal Knowledges, and Cultural interests, on which the graduate school enrollees lead those who do not enroll. The Outdoors and Shop and Sociability scales work in the opposite direction, with those not enrolling in graduate school having the higher means. The canonical correlation between the single possible discriminant function and the group membership function reveals how weak the relationship is, in that only about 10 percent of the variance in the criterion is predictable from the MAP factors.

Given that a male college graduate enrolls in a graduate school, the best predictors among 12th-grade MAP measures of his choice of a major field are shown in Table 2.16 to be lead by Mathematics ability and Science and Cultural interests. Again the highest and lowest group means on the best predictors are very reasonable. Table 2.17 seems to support the contention that the best discriminant plane for graduate school majors is just about where it was in the 22-dimension space for undergraduate majors, and the plot of the 14 graduate majors given as Figure 2.4 from the discriminant centroids data of Table 2.18, closely resembles that of the undergraduate majors given as Figure 2.3.

The extent to which dropping out of college can be predicted from 12th-grade MAP measures has been studied in the context of a five-category criterion, as indicated by Table 2.19. Again, a combination of abilities and interests does the work, and the male college dropouts are seen to be at about the level of junior college terminals and below the other groups which seek or possess baccalaureate degrees.

The final discriminant analysis reported in this Chapter involves marital adjustment as a criterion. Although this is not an educational criterion it undoubtedly interacts with educational adjustments in ways that will be explored in further Project TALENT research. Table 2.20 shows that marital status of males five years out of high school is related to senior year MAP profiles. As a group, young men who have remained single were more academically able and oriented. The ranking

Table 2.15: Discriminant Analysis of Male College Graduates Attending Graduate School versus Male College Graduates Not Attending Graduate School, in 12th-Grade MAP Factors Space (Total N = 5095)

MAP Factor	Predictor Rank	Correlation	Discriminant Loading	Means Graduate School (N=2648)	Means No Grad. School (N=2447)
Abilities					
VKN	2	.17	.49	60	58
PSA			-.04		
MAT	1	.18	.52	75	70
H-F			-.21		
ENG			.18		
VIS			-.08		
COL			.25		
ETI			-.07		
MEM			.04		
SCR			-.29		
GAM			.12		
Motives					
BUS			-.20		
CON			.11		
SCH	7	.11	.31	58	56
OUT	4.5	.13	-.38	58	61
CUL	3	.16	.47	41	37
ACT			-.14		
IMP			.01		
SCI	8	.10	.28	68	66
SOC	4.5	.13	-.38	47	50
LEA			.20		
INT			.13		
Discriminant:	Canonical Correlation		.34	53	46

Table 2.16: Graduate School Major Field Centroids on Best 12th-Grade MAP Predictors for 1975 Males

Rank:	7	1	5	6	8	3	2	4
Factor:	VKN	MAT	VIS	BUS	OUT	CUL	SCI	SOC
MultR:	.27	.49	.30	.28	.27	.37	.38	.34
Major								
MATH	58	85	57	49	57	38	70	43
PHYS	61	84	60	43	60	39	73	42
BIOS	59	75	57	43	60	41	72	48
PSYC	61	74	56	46	55	46	68	49
HIST	65	68	54	48	54	49	65	47
SOCS	64	70	53	48	57	44	68	49
ENGL	65	70	53	46	55	51	62	48
RELG	62	68	55	47	57	45	62	45
LAW	62	73	56	50	55	43	68	51
MED	62	81	57	44	56	42	75	44
DENT	58	75	60	46	60	38	74	49
ENGI	58	84	63	47	63	34	72	41
EDUC	58	66	54	49	60	41	63	51
BUS	60	77	57	52	57	36	69	49

Table 2.17: Factor-Discriminant Function Correlations for Graduate Major Fields in Male 12th-Grade MAP Space

Factor		DFI	DFII
	Canonical Correlation	.60	.39
Abilities			
VKN		-.27	.41
PSA		-.02	-.06
MAT		.75	.16
H-F		.22	-.13
ENG		-.13	.11
VIS		.46	-.09
COL		-.00	.07
ETI		.07	-.12
MEM		-.06	.13
SCR		.22	-.15
GAM		.19	-.19
Motives			
BUS		-.19	-.57
CON		-.06	-.01
SCH		.27	.28
OUT		.31	-.23
CUL		-.49	.57
ACT		.09	-.06
IMP		-.17	-.02
SCI		.52	.19
SOC		-.43	-.36
LEA		-.20	-.12
INT		-.06	.05

DFI: Technical versus Sociocultural

DFII: Cultural versus Business and Social

Figure 2.4: Centroids of Graduate School Major Fields In Discriminant Plane (data in Table 2.14)

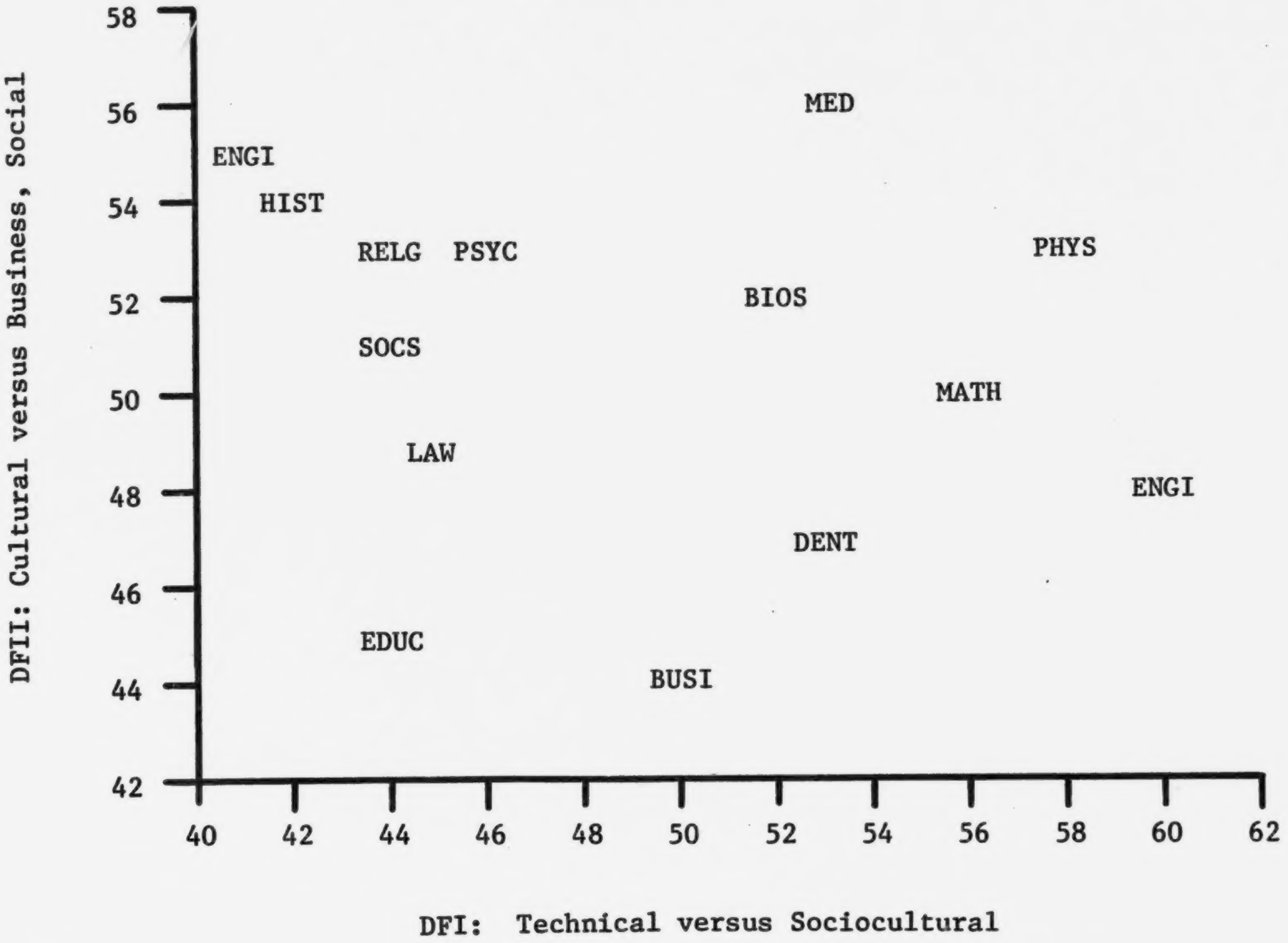


Table 2.18: Discriminant Function Centroids for 14 Graduate School Majors in Best Discriminant Plane of 12th-Grade MAP Space (N = 1975 Males; $T = 10_z + 50$)

Mnemonic	Graduate School Major	Sample Size	DFI	DFII
MATH	Mathematics	90	56	50
PHYS	Physical Sciences	155	58	53
BIOS	Biological Sciences	111	52	52
PSYC	Psychology	89	47	53
HIST	History	83	42	54
SOCS	Social Sciences	83	44	51
ENGL	English	77	41	55
RELG	Religion	115	44	53
LAW	Law	289	45	49
MED	Medicine	204	53	56
DENT	Dentistry	75	53	47
ENGI	Engineering	215	60	48
EDUC	Education	170	44	45
BUSI	Business	219	50	44

DFI: Technical versus Sociocultural
DFII: Cultural versus Business and Social

Table 2.19: Male College Dropouts Comparisons in the 12th-Grade MAP Factors Space (N =3232)

	Means for Best MAP Predictors					
Rank:	2	1	3	5	4	
Factor:	VKN	MAT	SCH	OUT	SCI	Discriminant Means
MultR:	.28	.34	.28	.20	.21	
Criterion Groups						
1) Graduates of 4-year colleges (1421)	59	72	57	59	68	56
2) Dropouts from 4-year colleges planning to return for degree (450)	57	67	53	61	66	49
3) Junior College grads transferring to 4-year college (265)	55	65	52	62	67	47
4) Junior college terminal graduates (206)	53	62	51	64	63	43
5) Dropouts from 4-year colleges with no plans for returning (890)	53	61	51	63	62	44

Canonical R = .53; 55% correct classifications.

Table 2.20: Marital Status Five Years Out of High School Discriminant Analysis in the 12th-Grade MAP Factors Space (All 1628 Subjects are Males)

	Best MAP Predictors					
Rank:	3	1	2	5	4	
Factor:	VKN	MAT	SCH	ACT	SOC	Discriminant
MultR:	.18	.23	.21	.15	.18	Means
Criterion Groups						
1) Single (731)	55	66	53	50	49	54
2) Married, No Children (335)	54	64	53	52	52	50
3) Married with Children (324)	51	60	49	53	52	46
4) Divorced (238)	52	58	48	54	53	44

Canonical R = .35; 46% correct classifications.

of the four groups on the best discriminant function, placing divorcees at the lowest rank, is interesting.

In this Chapter we have reviewed some of the literature on prediction of educational adjustments in high school and in higher education, and have documented our Project TALENT studies in the area. We refrain from summarizing the Chapter because we want to present reviews and new studies on occupational and career development criteria first, which we do in Chapters Three and Four. In Chapter Five we will attempt to place the generalizations about educational development of young adults that are supported by this Chapter in the context of a general theory of the emergence of adulthood from adolescence.

CHAPTER III

Predicting Occupational Placements

"Vocational psychology, from its beginnings early in this century until recently, was essentially a psychology of occupations" (Super, 1961). The author of the statement has contributed more than any other person to the recent conversion of emphasis in vocational psychology from the status-type criteria of occupations to the developmental-type criteria of career patterns. In Chapter IV we express our enthusiasm for giving priority in theory and research to developmental criteria, but first we propose to review the values and shortcomings of status criteria, and to report on the descriptions of selected occupations provided by their centroids, or mean profiles, in the MAP measurement space.

One of the earliest landmarks in vocational psychology is the World War I study of intelligence means of groups of soldiers from various civilian occupations. Between the wars, Paterson and Darley made the University of Minnesota a center for the study of ability differences among occupations, while Strong pursued interest differences among occupations relentlessly and successfully (Paterson and Darley, 1936; Strong, 1943). The high-water mark for studies of the distribution of individual differences among occupations is Thorndike and Hagen's Ten Thousand Careers (1959). We parse their study in some detail for the view it gives us of what Super calls "the occupational model" of research. The authors stated the objectives of such research as follows:

> Ideally, we would like to know for any occupation (1) what the men (or women) now in the occupation were like at the age when they were deciding to enter the occupation, that is, at the age when vocational guidance might have been given them, and (2) what measures of ability or personality administered at that time would have predicted their later success or satisfaction in the occupation. (Thorndike & Hagan, 1959, 2)

Clearly the occupational model calls for observations at two points separated in time, and the correlation of the antecedent trait measures with the follow-up status measures.

Thorndike and Hagen used a very ingenious design to reduce the economic cost of such research. They capitalized on existing test records for 17,000 men out of the nearly half a million men who had been tested as Army Air Force Aviation Cadet candidates during World War II. They undertook to correspond with this group about a dozen years after the men returned to civilian life, and to scale from their responses seven criteria of occupational success and satisfaction. To anyone inclined to think that 17,000 subjects (some 10,000 of whom provided usable follow-up protocols) is too many, Thorndike & Hagen (1959, 3) reply that "the 17,000 cases of the present study are still too few to provide adequate samples in many occupations of great importance that employ large numbers in our working population." It is not difficult to list as many as 1,000 occupations actively practiced in the United States. The authors chose to employ 124 occupational groups. They say that "the body of evidence on tests as long-range predictors of occupation entered or of subsequent success in an occupation is very limited. It is this gap that our study tries in part to fill" (p. 3).

The Army Air Force battery provided 20 tests and five composites, as listed in Table 3.1. This table also lists the seven criterion scales based on the follow-up questionnaires. It should be noted that the subjects, as cadet candidates, were a superior group of men, mostly high school graduates despite the depression, and many with college experience. It is interesting to compare the test battery employed by the Army Air Force Psychology Program under Flanagan's direction with the Project TALENT battery, also assembled under his direction. The TALENT battery is broader-gauged, as one would expect, but it has none of the psychomotor apparatus tests the Air Force battery contained. Apparatus tests were administratively unfeasible for Project TALENT. The composites based on the Air Force battery are presumable substantially intercorrelated, and provide an interesting contrast to the uncorrelated MAP factors of the TALENT battery.

The bulk of 10,000 careers is taken up with data reports on the

Table 3.1: Measurements Employed in 10,000 Careers

I. The Predictor Domain (1942-1946)

1. Reading Comprehension - technical material
2. General Information (Navigator)-vocabulary of science
3. Mathematics - arithmetic, algebra, trigonometry
4. Arithmetic Reasoning - word problems

   1 through 4 pooled as a general intellectual ability or scholastic aptitude composite (G)
5. Numerical Operations I - addition, multiplication
6. Numerical Operations II - subtraction, division
7. Dial and Table Reading

   5 through 7 pooled as a numerical fluency composite (N)
8. Speed of Identification - visual speed
9. Spatial Orientation I
10. Spatial Orientation II

    8 through 10 pooled as a speed and accuracy of visual perception composite (Ps)
11. Mechanical Principles
12. Two-Hand Coordination - apparatus test
13. Biographical Data Blank (Pilot Key) - mechanical experience

    11 through 13 pooled as a mechnical ability and experience composite (M)
14. Complex Coordination - appartus
15. Rotary Pursuit with Divided Attention
16. Finger Dexterity
17. Aiming Stress

    14 through 17 pooled as a psychomotor composite (Pm)
18. General Information (Pilot) - potpourri
19. Discriminant Reaction Time - complex
20. Biographical Data Blank (Navigator Key) - mathematical background

Table 3.1 (continued)

II. The Criterion Domain (1955-1956)

1. Monthly Earned Income
2. Number Supervised
3. Self-rated Success (4-point scale)
4. Self-rated Job Satisfaction (4-point scale)
5. Vertical Mobility
6. Lateral Mobility
7. Length of Time in Occupation

124 groups of occupations. Table 3.2 is excerpted to show how mean profiles of specific groups are reported. Nowhere in the book are there any analysis of variance tests to justify the assumption that any of the group contrasts made available are significant. The authors also classify the occupational groups by type of highest ability and by average score level over all five composites, but again without evidence for the non-chance nature of the profile comparisons involved. In this analysis, for example, college professors and teachers of high school math and science (78 subjects) peaked on general intellectual ability and were of high general level, whereas teachers of high school English, languages, and social studies (49 subjects) peaked on the psychomotor composite but were of low general level. No tables of intercorrelations among tests or composites are given, and standard deviations are given for only one group (accountants and auditors [p. 31]), where they run as high as for total sample. Despite the lack of statistical detail, there can be little doubt that some of the available contrasts are meaningful, as for example the staggering contrast between the two breeds of high school teachers at the bottom of Table 3.2. What is in doubt is whether enough of the profile comparisons are significant to justify the publication of all the profiles.

Thorndike and Hagen (1959) computed approximately 12,000 product-moment correlations between the predictors and the seven criterion scales. Their remarkable conclusions after all this effort need to be transferred in their own words.

> The most reasonable interpretation of the complete set of validity coefficients that we obtained seems to be that they are chance deviations from a population value of zero. The null hypothesis (i.e., the hypothesis of zero validity) seems adequate to account for our results. (p. 45)
>
> In general conclusion, we must say that though it is possible that tests of aptitude can show validity in long-range predictions of occupational success when individuals are employed in jobs in widely different specific companies and settings in widely different parts of the country, our data give little evidence to encourage this belief. (p. 48)

Table 3.2: Occupation Group Means on Five Score Composites
(Grand Mean = 0; s.d. = 100)
(Thorndike & Hagen, 1959)

	G	N	Ps	M	Pm
Architects	44	4	74	8	14
Assemblers, production	-83	-76	-46	-27	-34
College Professors	75	38	33	-33	1
Engineers, chemical	106	42	30	19	20
Laborers	-33	-36	-13	-18	-24
Miners, drillers	-43	- 4	73	75	80
Pharmacists	29	39	- 9	- 7	15
Physicians	59	20	18	2	0
Teachers, h.s. math and science	35	11	- 4	- 1	- 2
Teachers, h.s. humanities	-50	-37	-20	-102	-18

Besides characterizing their correlation studies as complete washouts, the authors express the gravest doubts about the usefulness of the group mean profiles they report in such detail.

> While recognizing the real, sizable, and in most cases, sensible differences between groups, we must also recognize that the variability within any group with respect to any given aptitude dimension was quite marked. It is easy to over emphasize the between-group differences. For individuals already as able and select as the ones with whom we had to deal there were probably no absolutely disqualifying limitations in the aptitude dimensions. (p. 49)

What happened? Why did this grand test of the trait-and-factor approach to vocational psychology yield so little? This work was done at a time when computers were still new tools for behavioral scientists, and certainly the statistical methodology that could be brought to bear on the author's data in today's computer shops would enable some improvements in design that might lead to improved results. First and foremost, however, what happened was that the authors paid a fearsome price for their lack of a theory of occupations that would have allowed them to group their occupations according to a reasonable and predictable taxonomy. It was "the occupational model" that probably failed, not the measurement model. Interestingly, Thorndike and Hagen gave a preview of the methodology the computer was to make available to researchers employing "the career model" when they reported a multiple group discriminant analysis, computed for them by P. J. Rulon, for 22 selected business and professional groups in the 20-variable test space. A fairly convincing map of the groups emerged in a best discriminant plane oriented by a quantitative intelligence dimension and a verbal versus mechanical dimension.

One of the advantages of what Super calls "the career model" of research in vocational psychology is that it encourages the search for theoretical taxonomies of occupations. We will look at the career model in great detail in the next chapter, but at this point we illustrate how it has influenced the choice of a dependent or criterion variable in recent research. First, however, we have to admit that if 10,000 Careers discouraged the further use of the occupational model in an abilities measurement space, it did nothing to discredit the use of the occupational model in an interests measurement space, and some of the experts on interests measurement continue to espouse specific occupations as criterion groups. Without reviewing the compendious literature on vocational interests, we can remind the reader that part of the work has followed the lead of Strong and of the Minnesota group in focusing on a long list of specific job titles as criteria to be predicted, while other research has followed the style of Kuder in organizing occupations into a short list of fields of endeavor. The ten fields of the Kuder Preference Record (1956) are: 1. Outdoor, 2. Mechanical, 3. Computational, 4. Scientific, 5. Persuasive, 6. Artistic, 7. Literary, 8. Music, 9. Social Service, 10. Clerical. A good example of interests research using the occupational model is Clark's The Vocational Interest of Nonprofessional Men (1961). Clark employed the Minnesota Vocational Interest Inventory, which is empirically keyed to specific occupations. He summarizes the position underlying such instruments as follows:

> What this report does indicate...is (1) that skilled trades groups are different from one another, (2) that these differences are substantial enough to be used in classification and in counseling, (3) that an interest inventory used with such groups can be scored in such a way as to reflect these differences reliably, and (4) that such scores have merit when used in a counseling or classification situation. (Clark, 1961, 9)

If we have an argument with Clark it concerns the issue of what differences among criterion groups actually are large enough to be used in counseling. We are willing to sacrifice the opportunity to make tenuous discriminations among similar jobs in order to cluster similar jobs together into families of occupations among which fairly firm discriminations are possible. We also feel that criterion-keyed inventory reports confuse the client by suppressing any talk of general interest traits and striking directly to talk of jobs. We believe that talk about his standing on a few uncorrelated interest dimensions clarifies the meaning of trait predictors for the client. Clark seems to concede this point when he says, "Homogeneous scales are very attractive because they involve such a small amount of scoring and provide a number of independent scores small enough for the human mind to grasp." (Clark, 1961, 58) Of course, the homogeneous scales employed in scoring inventories such as the Kuder do not provide independent scores, and the four orthogonal interest factors in the MAP motives profile may be a step in this direction. Clark finally endorses a combination strategy for interest research:

> I think it likely that the best measure would be a combination of the empirical key which is developed by looking at the world of work and the homogeneous key which is developed by looking at individuals. We would use a combination in order to capitalize upon the advantages gained by two different ways of looking at the same variable. (Clark, 1961, 119)

The discriminant functions defined on MAP factors reported in this and the next chapter represent such combination measures exactly. We have already suggested that these linear functions of traits may be seen as heuristic definitions of talents for the criterion variables that orient them.

Clark offers the conventional hypothesis about the different relationships of abilities and interests to vocational criteria.

> Interest measures should provide data on the direction for an individual to take, as against level. Aptitude measures indicate something about the general level of the occupation; at any one level there are a wide variety of occupations each requiring substantially different interest patterns for the employee. (Clark, 1961, 117)

Our theory contradicts this, and asserts that abilities and interests interact to determine, in concert with other forces, both level of aspiration and direction of aspiration. The discriminant analyses of this and the next chapter confirm our theory, in that the best discriminant functions for vocational criteria always turn out to be joint functions of abilities and motives. Clark's hypothesis is too simplistic for the complexities of human nature. It ignores the substantial intercorrelations of differential abilities with differential interests.

Helen Astin (1967a) recently reviewed the research literature on changes in vocational aspirations over time, including the evidence from Project TALENT. In four studies based on national samples she found a consistent pattern of aggregate shifts in aspirations. "Business and Educational gain in percentages of subjects aspiring to those occupations at the termination of high school, one year after high school, and at the time of graduation from college. Furthermore, Engineering and Sciences tend to lose subjects at these same points." (Astin, 1967a, 544) Her major explanation of these trends is as follows:

> ...students tend to move toward less specific - as far as the functions and the level of skills required - and less demanding careers. Essentially, it appears that the student becomes aware of the realities about the skill and extensive training necessary to achieve in scientific or engineering careers, and thus shifts to more appropriate and realistic choices where he feels that there is a greater chance for success and rewards. (Astin, 1967a, 545)

Astin regroups the data of the four source studies so that the occupations are classfied into five clusters: 1. Business, 2. Engineering, 3. Science, 4. Education, 5. Professions. These are exclusive but obviously not exhaustive. The five categories, which we might call macro-groups, are indicative of the service that coarse groupings of occupations are rendering in current vocational psychology. Elsewhere, Helen Astin (1967b) has reported a discriminant analysis research into the predictability of twelfth grade occupational aspirations of TALENT Retest Study males from their ninth grade abilities and interests and from several school-environment characteristics. For this study she used a seven-category criterion variable, supplementing her five categories listed above with the additional categories of "Noncollege" and "Unclassified," in order to make the rubrics exhaustive. She found that the school variables contributed slightly to predicting this criterion, but that the main work was done by the personality measures, particularly the interest and plans scales. Her conclusion is that "students, by the time they enter ninth grade, have interests and personal orientations that are predictive of the career choices they make when they are about to terminate their high school education." (Astin, 1967b, 97)

Madaus and O'Hara (1967) looked at the relationships between interests of high school boys as scaled by their ten Kuder Preference Record scores and their occupational aspirations as grouped in nine clusters: 1. Science, 2. Business, 3. Medicine, 4. Priest, 5. Law, 6. Nonprofessional, 7. Social Science, 8. Military, 9. Engineer. The particular choice of groupings stems from the fact that the 979 subjects were an entire student body of an all-male Catholic high school but again we have a short and simple classification of occupational titles. Madaus and O'Hara employed an extremely sophisticated research design to excellent advantage. Having subjects in four school grades and nine criterion categories, with ten interest measures per subject, they computed a factorial multivariate analysis of variance for the groups, grades, and interaction of groups with grades hypotheses. They found both main effects significant ($p<.001$) and the interaction effect insignificant. They interpreted the failure to reject the null hypothesis of zero interaction as showing that "the pattern of differences among occupational categories was the same for all four years of high school." (Madaus and O'Hara, 1967, 106) In a nice example of the kind of combination strategy Clark calls for, these authors fitted two useful discriminant functions to the task of separating the nine aspirations groups. They then went on to show by means of a large number of significant two-group $\underline{T}^2$ values that the among-groups "differences were more specific than science - nonscience differences found in previous research" (p. 106). The authors concluded their virtuoso analytical performance by computing classification probabilities for the subjects in the space of the ten Kuder scales, assigning each subject to a group according to his highest probability, and arriving at the hit rates for groups we array in Table 3.3. Compared with the hit rates expected by chance, in the light of the *a priori* group sizes, the obtained hit rates are convincing evidence of the relationship between Kuder interests and aspiration groups. We salute this analytical *tour de force* enthusiastically, even as we wish they had had more representative subjects and that classification probabilities had been computed for a cross-validation sample of subjects.

In a seven-year follow-up of 3,378 male graduates of Wisconsin secondary schools, Little (1967) departed from the use of nominal macro-groups as a vocational criterion, and substituted an ordinal variable derived by assigning "prestige" scores to occupations. Ten levels of occupational prestige were employed in the analysis, which related educational attainment to the criterion, with the following results:

> To summarize, occupations at any of the prestige levels were attained by persons with any of the three levels of schooling. The overlapping was particularly large in the middle-level

Table 3.3: Percentage Correctly Classified into Each of Nine Groups and Percentage Expected on the Basis of Random Assignment (Madaus and O'Hara, 1967, 111)

Aspirations Group	% Actual Hits	% Expected Hits
1. Science	53.5	10.6
2. Business	35.7	17.3
3. Medicine	53.7	16.6
4. Priest	58.8	8.4
5. Law	32.1	6.9
6. Nonprofessional	16.7	2.9
7. Social Science	38.1	10.4
8. Military	30.8	6.5
9. Engineer	70.4	20.1
TOTAL	48.6	13.8

> occupations where college degrees are not a stated prerequisite. However, the occupational advantage of most persons who had attended college is definite; the occupational handicap of most persons who had no education or training beyond high school is serious. This is not to imply, however, that the differences in occupational attainment were attributable to differences in educational opportunity. Variations in human aptitude and aspiration growing out of a complex of psychocultural factors were definitely at work. (Little, 1967, 149)

Gribbons and Lohnes (1965) have studied five-year follow-up and seven-year follow-up (1967) predictive validities of eight Readiness for Vocational Planning (RVP) scales based on eighth grade interview protocols. Occupational aspirations and placements of 110 subjects were scaled in two ways, according to level and to field. Anne Roe's (1954; 1956) definitions of these scales, which are discussed later in Chapter Four, guided the criterion scaling, but the small number of subjects available made it necessary to reduce the number of categories on each variable. The results were that level of occupational aspiration in senior year and two years out of high school, as well as level of occupational placement two years out, were found to be related to RVP profiles by MANOVA analyses, but field of aspiration in senior year and two years out were found to be unrelated to RVP profiles. Field of actual occupational placement two year out of high school was found to be related to RVP. These findings have their place in a larger inquiry by which the authors are attempting to discover what aspects of subsequent vocational behavior are and are not predictable from eighth grade RVP performances. In their choice of Anne Roe's levels and fields as dependent variables, the authors have had recourse to the most popular bases for vocational macrogroups in current usage. Roe's six levels and eight fields are listed in Chapter Four.

We have been citing recent researches to illustrate the strong tendency of vocational psychologists today to focus inquiry on differences among a few large groups or families of occupations, rather than on specific occupations. This tendency is partly a recognition of the reality that specific occupations do not work well as research criteria. There are far too many of them and there is far too much overlapping among them in any measurement space. Successful empiricism requires discriminable taxonomies. The tendency also reflects a spreading belief among vocational guidance counselors that youth does not need and should not be encouraged to think in terms of specific occupations. Super has given the most generally accepted definition of vocational guidance:

> Vocational guidance is the process of helping a person to develop and accept an integrated and adequate picture of himself and of his role in the world of work, to test this concept against reality, and to convert it into a reality, with satisfaction to himself and benefit to society. (Super, 1957, 196)

This view of vocational guidance requires counselors to help young people to develop broad and comprehensive cognitive maps placing themselves in relation to the "continents" of the world of work before attention is allowed to narrow down to details about specific occupations as objects of choice. This is not to deny the usefulness and indeed the necessity of details about specific jobs as illustrations of the contents of experiences in the macrogroups, but the contents of pedagogy are not to be confused with the objectives of pedagogy. Our responsibility is to guide youth to comprehensive understanding of self in relation to decision making about careers. We should prepare youth to go the last mile alone. Ruth Barry and Beverly Wolf quote Robert Thorndike as saying in the New York Herald Tribune (December 13, 1959) that we "don't know enough to guide a man into a specific career." Then, in their epitaph for prescriptive vocational guidance, they apply a comment of Winston Churchill's: "There but for the grace of God, goes God." (Barry and Wolf, 1962, 201) Today's vocational psychology is not intended to assist anyone in playing God with the personal destinies of youth.

In order to feel and to be reasonably secure in a society in which technology is changing constantly and rapidly, most individuals in the labor force should be able to think of themselves (correctly) as possessing particular sets of general vocational capabilities, rather than as workers skilled at specific jobs. The American Institutes for Research has conducted an extensive program of research into the measurement and classification of general vocational capabilities under the direction of Altman (1966), and has helped to develop in the Quincy, Massachusetts schools a vocational guidance program and a vocational training curriculum based on this research. We think that these efforts represent a very convincing alternative to measurement and training oriented to specific jobs. In an extensive monograph reporting the research program, Altman (1966) describes a domain of general vocational skills and knowledges, the basic organizing principle of which is a lattice structure of vocational contents ordered in the first direction along a hardware-to-people continuum, and in the second direction in a hierarchy of psychomotor and cognitive complexity of tasks. The six levels of the hardware-to-people dimension are: 1. Mechanical, 2. Electrical, 3. Spatial-structural, 4. Chemical and biological, 5. Symbolic, 6. People. The twelve psychological processes in the hierarchy of complexity are (from least to most complex): 1. Sensing, 2. Detecting, 3. Chaining or rote sequencing, 4. Discriminating or identifying, 5. Coding, 6. Classifying, 7. Estimating I: discrete case, 8. Estimating II: tracking, 9. Logical manipulation, 10. Rule using, 11. Decision making, 12. Problem solving. Any identifiable task component of any job can be classified in this lattice model, and so can many types of vocational aptitude tests. Altman proposes that this model can provide the guidance client with a conceptual bridge between the considerations of general career planning and the decision involved in preparing for, finding, and adjusting to a specific job. We concur, and we imagine a developmental sequence in the earlier stages of which the student learns to understand himself in terms of the MAP factors and to understand the world of work in terms of the tree structure of careers we give in Chapter Four, and learns to relate the two in a personal planning equation; then in the later stages of the developmental process the student would approach vocational maturity with the assistance of Altman's taxonomy of vocational capabilities in crystallizing and establishing his career sequence through actual jobs found and held. Nowhere in this process is the client encouraged to fixate on a single job as the goal and limit of his vocational identity. The effort is to help the client key himself for personal growth and adaptability to social change.

Vocational Placements Five Years Out Of High School

The thrust of our argument is against attempts to discriminate specific occupations, nevertheless we need to demonstrate the weakness we claim for the occupational model and to report such useful information as can be generated using it. Since it is the noncollege TALENT subjects who have found their ways to placements in specific jobs by five years out of high school, we report the results of a multiple group discriminant analysis of 40 job fields in the MAP factor space, for fields of work that do not require college degrees. The MAP factor scores for the 5,472 male subjects are based on twelfth grade test performances. The subjects are all those 12th grade male five-year follow-up file members who met all of these requirements: 1) has no four-year college degree and is not seeking one; 2) has been at least two months on his present job; 3) has no desire to change to a different job field from the one in which he is working; 4) is working at a job for which at least 23 qualifying subjects can be found on the data file (since there are 22 MAP predictor variables). The 40 job fields that form the criterion groups for the analysis are the ones that were located when the data file was sifted according to these rules. They are 40 categories out of Project TALENT's primary 84-category occupations code. The largest groups are Clerk (600 subjects), Laborer (597 subjects), and Businessman (518 subjects). The smallest groups are Engineer (23 subjects), Entertainer (24 subjects), and Aviator (25 subjects).

From a statistical viewpoint, the 40 groups are significantly discriminated in the 22-variable MAP factors space. Table 3.4 gives the group centroids (profile of means) on the ten most useful MAP predictors (of which four are abilities and six are motives), and the multiple correlation coefficient for the regression of each factor on an optimal linear combination of the 40-element vector variate for group membership (on which each subject has a "1" for the group he belongs in and a "0" for every other group). Notice that these multiple correlations are very modest in magnitude. Centroids are not reported for six of the groups which were not significantly discriminated

Table 3.4: Occupational Group Means on Best MAP Predictors (Five-Year Follow-Up of 12th-Grade Males), with Multiple Regression Coefficients for Factors

Occupational Group	Rank:	2	3	10	7	5	6	1	8	4	9
	Factor:	VKN	MAT	ENG	VIS	BUS	SCH	OUT	CUL	SCI	SOC
	Mult R:	.31	.29	.17	.22	.23	.23	.32	.20	.27	.19
Electronics Technician		54	66	38	63	45	52	65	35	66	49
Engineer		55	66	39	63	47	53	60	37	69	50
Programmer		54	69	42	59	51	54	60	35	66	51
Teacher		59	69	45	55	47	54	56	43	64	51
Accountant		54	61	42	55	53	51	60	36	63	52
Businessman		53	59	39	57	50	49	62	37	62	53
Artist		54	53	39	62	39	48	62	45	56	54
Engineering Technician		53	67	39	60	47	52	65	35	67	50
Aviator		59	68	38	63	43	54	62	37	69	47
Draftsman		52	62	38	62	46	48	65	37	63	52
Photographer		57	57	35	56	45	48	62	40	60	53
Medical Technician		57	62	38	58	45	49	61	38	67	50
Tabulator Operator		54	59	42	56	52	51	61	36	61	52
Bookkeeper		51	56	44	54	55	51	60	41	55	54
Clerk		53	58	41	55	51	50	62	38	60	52
Salesman		53	57	40	57	51	49	61	38	61	55
Sales Clerk		47	56	39	55	49	46	66	37	56	51
Entertainer		63	59	38	60	44	52	57	49	62	52
Armed Forces		54	61	38	59	48	49	65	36	63	51
Policeman		54	54	38	56	46	47	66	38	61	55
Electrician		51	59	38	61	46	48	67	36	62	51
Machinist		49	58	38	60	45	47	68	34	61	51
Mechanic		50	57	37	61	46	47	67	34	60	49
Carpenter		47	53	38	60	45	45	70	36	56	50
Metalworker		48	54	37	60	47	45	70	33	59	51
Painter		49	55	36	58	49	47	70	38	59	52
Equipment Operator		45	56	38	58	44	45	69	32	58	52
Driver		48	53	38	58	47	45	69	35	57	50
Printer		51	55	39	55	48	45	65	36	57	51
Barber		46	53	39	56	48	47	65	39	57	53
Farm Laborer		43	56	38	58	45	45	72	33	56	45
Laborer		48	55	38	57	48	47	67	36	59	52
Farmer		44	56	41	59	46	46	73	33	55	47
Outdoors (Other)		48	54	40	60	46	43	71	36	58	51

in the analysis. Table 3.5 defines the two best discriminant functions each of which is a mix of ability and motive factors. The first discriminant function, dominated by Verbal Knowledges, we have named Science-oriented Scholasticism. The second function we have named Technical versus Sociocultural Orientation. Very similar functions orient the best discriminant planes in our more convincing and useful studies of career criteria reported in Chapter Four. Notice that the canonical correlations between these functions and the optimal functions of the group membership vector variate are very modest. Table 3.6 reports the group sizes and their centroids on the discriminant plane. The groups have been ordered on the first discriminant function. Figure 3.1 maps the groups on the discriminant plane.

There is enough here to show that given adequate subjects and measures, as TALENT has, and adequate statistical procedures, research on the occupational model can have modest success. In the next chapter we attempt to show that research on the career model can have much greater meaning and utility.

Table 3.5: Factor-Discriminant Correlations and Canonical Correlations for 40 Five-Year Follow-Up Occupational Placements in Twelfth-Grade MAP Space

	Discriminant Functions	
	I	II
Canonical Correlations	.46	.34
MAP Factors		
Abilities		
Verbal Knowledges	.61	.19
Perceptual Speed, Accuracy	.22	-.05
Mathematics	.36	.60
Hunting-Fishing	-.22	.29
English Language	.17	-.24
Visual Reasoning	-.11	.57
Color, Foods	.11	-.02
Etiquette	-.02	-.24
Memory	-.03	-.05
Screening	-.30	.14
Games	.28	.08
Motives		
Business Interests	.27	-.44
Conformity Needs	.20	-.06
Scholasticism	.41	.26
Outdoors, Shop Interests	-.65	.18
Cultural Interests	.26	-.20
Activity Level	-.05	.03
Impulsion	.03	.02
Science Interests	.41	.53
Sociability	.22	-.29
Leadership	.02	-.13
Introspection	-.07	.09

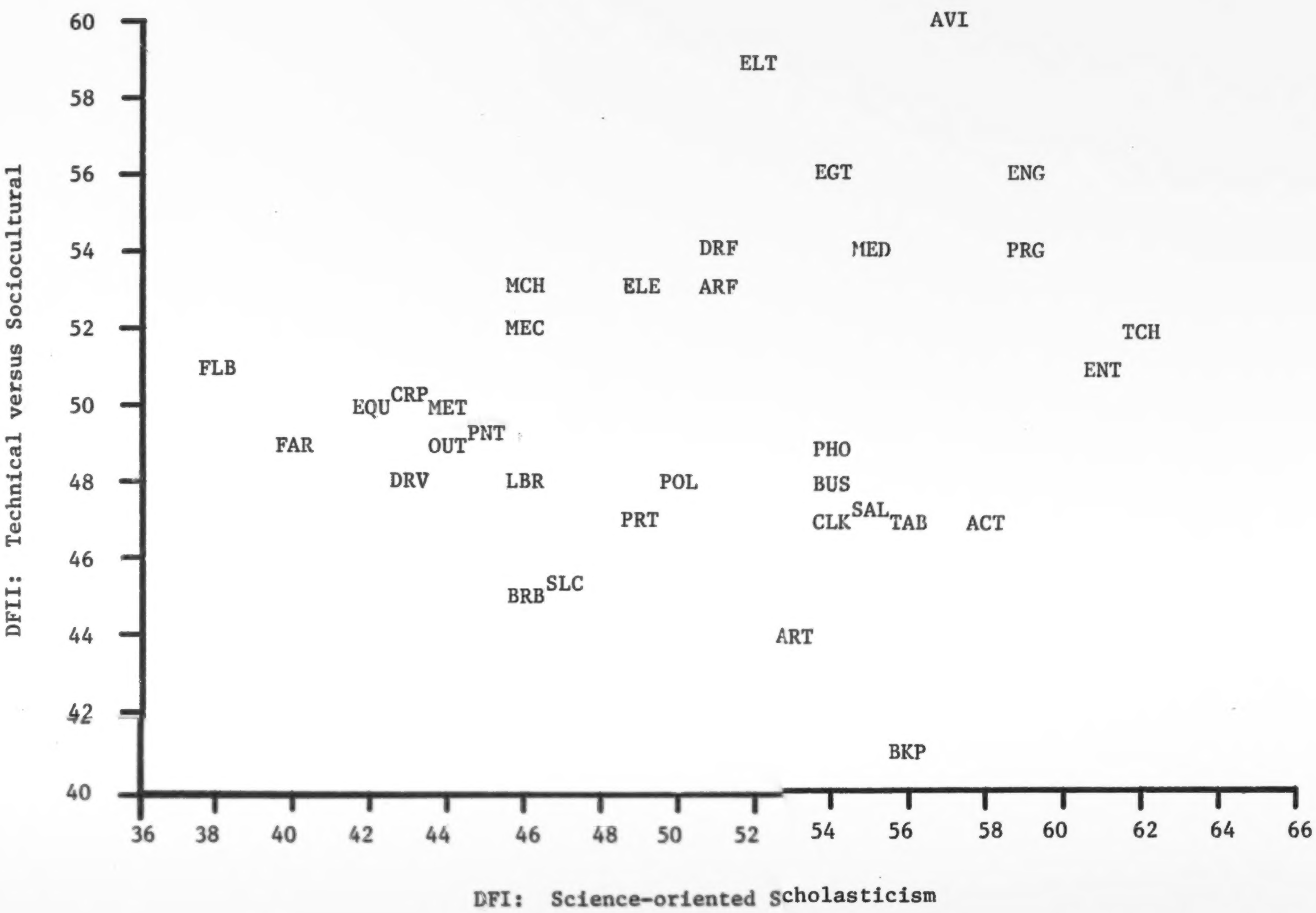
DF I: Science-oriented Scholasticism

DF II: Technical Versus Sociocultural

Table 3.6: Discriminant Function Centroids for Five-Year Follow-Up Occupational Groups

No.	Mnemonic	Group	Size (N)	DF I	DF II
1	TCH	Teacher	29	62	52
2	ENT	Entertainer	24	61	51
3	PRG	Programmer	42	59	54
4	ENG	Engineer	23	59	56
5	ACT	Accountant	95	58	47
6	AVI	Aviator	25	57	60
7	TAB	Tabulator Operator	91	56	47
8	BKP	Bookkeeper	29	56	41
9	MED	Medical Technician	51	55	54
10	SAL	Salesman	258	55	47
11	BUS	Businessman	518	54	48
12	CLK	Clerk	600	54	47
13	PHO	Photographer	28	54	49
14	EGT	Engineering Technician	174	54	56
15	ART	Artist	26	53	49
16	ELT	Electronics Technician	242	52	59
17	DRF	Draftsman	147	51	54
18	ARF	Armed Forces	208	51	53
19	POL	Policeman	147	50	48
20	PRT	Printer	103	49	47
21	ELE	Electrician	319	49	53
22	SLC	Sales Clerk	70	47	45
23	MCH	Machinist	180	46	53
24	LBR	Laborer	597	46	48
25	MEC	Mechanic	306	46	52
26	BRB	Barber	35	46	45
27	PNT	Painter	80	45	49
28	MET	Metalworker	101	44	50
29	OUT	Outdoors (Other)	31	44	49
30	DRV	Driver	136	43	48
31	CRP	Carpenter	81	43	50
32	EQU	Equipment Operator	66	42	50
33	FAR	Farmer	189	40	49
34	FLB	Farm Laborer	32	38	51

Figure 3.1: Centroids of Five-Year Follow-Up Occupations
Groups in Discriminant Plane
(Data in Table 3.6)



Chapter IV

Predicting Career Patterns

Although the vocational guidance movement is at least as old as this century, its scientific underpinnings have long been known to be incapable of supporting the burden of the enterprise. In the previous chapter we reviewed the crucial research, Thorndike and Hagen's *10,000 Careers*, which best illumines the shortcomings of the half century of research focused on occupations. Despite its title, that study marked the zenith of the old research paradigm of the form

$$\begin{array}{c}\text{trait profile}\\\text{at time 1}\end{array} \xrightarrow{\qquad\qquad} \begin{array}{c}\text{occupation}\\\text{at time 2}\end{array}$$

Vocational psychology has enjoyed a remarkable surge since 1950, and this wave of progress is due in part to a new emphasis on *career patterns* as criterion, in opposition to occupational placement. A career pattern is the sequence of vocationally-relevant decisions made by a person over a major part of his life history, as it is extracted and classified by the scientist studying it.

In this chapter we first review the pioneering theorizing about career development of two research teams, Ginzberg and his associates, and Super and his associates, both working from Columbia University. Then we review some related work by other researchers and the previously published Project TALENT career research. Finally, we report a new career patterns formulation, in the shape of a Career Development Tree Structure, that incorporates TALENT five-year follow-up results with previous TALENT results. Besides its strong empirical basis, this Tree seems to incorporate the major features of important previous attempts at building either developmental models of careers or occupational taxonomies. It seems to us that the Career Development Tree provides a marriage of developmental and taxonomic models that can be very serviceable both to researchers and to counselors and clients involved in educational and vocational guidance activities.

Ginzberg and Associates

Ginzberg and his associates focused attention in studies of occupational choice on relationships between events in the preparatory period and later performances in vocational placements. They emphasized the need for a theoretical structure to which statistical findings could be tied. Their studies probed the interactions of "the individual's over-all life plan" and "powerful environmental forces." The pioneering formulations of this research team have exerted a pervasive influence on the field of career development psychology. Today we take for granted several of the basic generalizations launched by their book Occupational Choice (1951).

Ginzberg points out that the problem of choosing an occupation is uniquely difficult in our society because of its emphases on personal freedom and division of labor. Although our society is unwilling to dictate occupational placements (usually), the health and prosperity of the society depend on the proper utilization of the talents of its people, so that public policy must be concerned with the encouragement of appropriate career development. The National Defense Education Act of 1958 represents an intrusion of the federal government on the process of career development. Such intrusions are inevitable and proper, so long as they seek to influence rather than to dictate. Ginzberg observes that a critical stage in career development coincides with the general Sturm und Drang of adolescence, complicating the developmental process enormously. He also remarks that the problem is quite different for males and females in our culture, so that formulations will have to be sex differentiated. Males must choose occupations, whereas females can avoid the problem entirely if they choose to. Thus, the meaning of employment is basically different for the two sexes.

Since occupational choices are acts of individuals, a theory of occupational choice must have "recourse to psychological postulates that help to explain individual behavior." However, the theory has to be sociological as well, since "the process has roots in the interplay of the individual and reality." Realities of employment are social and economic in nature. Psychological and environmental variables react on each other in the choice process, and require to be studied together. Early in their work, Ginzberg and his colleagues located four classes of variables that impinge on the choice process. These are:

1. environmental, or "reality factors"
2. educational determinants
3. emotional determinants
4. personal values.

Research experiences soon revealed that simple casual relationships of specific variables from these classes to choice behaviors would not be forthcoming. The process was discovered to be a very complex one. The key to a workable approach was found in a review of European research on occupational development. Lazarsfeld (1931) suggested that a genetic approach was required. By this he meant a study of life histories to locate developmental sequences. "The use of the genetic approach entails the assumption that the final occupational choice can be understood only in terms of the stages of development through which the individual has passed" (p. 16). How obvious this approach seems today. It has been so successful it is almost dangerously standardized.

Having disposed of simplistic theories such as the "accident" theory that explains occupational choice as the outcome of a single, powerful external stimulus (Why is the fortuitous stimulus powerful for the individual?), and the psychoanalytic theory that explains choice as the working out of a character "impulse" (Why the particular working-out?), Ginzberg focused on the cumulative impact of a series of decisions made over many years. In a sense, he postulates that the chain of events in a life history acquires a lawfulness of its own, as more or less irrevocable turns are taken. Once occupational choice is defined as "a chain of decisions" (p. 28) the researcher is forced to accept a developmental model, "in which past behavior exercises the major influence upon present and future decisions" (p. 29).

The individual's expanding *awareness* of himself and his environment seems to Ginzberg to be the most important aspect of development. In this awareness the individual organizes whatever control he is to acquire over his own nature and the nature surrounding him. Through depth interviews the contents of awareness were probed relative to the following topics:

I. The self
  A. Capacities
  B. Interests
  C. Values
  D. Time perspective
II. Reality
  A. Family
  B. Environment
  C. World of work
  D. Life plan
III. Key Persons

In the interrelationships among these factors of awareness Ginzberg seeks the basis for a theory of occupational choice. In short, his theory is to be based on *cognitive contents* as they emerge over time in a *developmental sequence*.

The core data that inform Ginzberg's theory-building are protocols from interviews of 64 white Protestant and Catholic boys from prosperous families, all with at least 120 I.Q. There were eight subjects at each of eight age levels, from age 11 through graduate school age. In this design the researcher acquires a rich collection of data about each subject, but for a small pool of subjects. The design makes sense for the exploratory purposes of these pioneering social scientists, but obviously the generalizations inspired by these data should be viewed as hypotheses requiring extensive testing.

The peculiar role assigned to verbal reports on the contents of awareness in this research is justified by the intrinsic requirement for rationalization in good occupational decisions. "Occupational choice is the type of problem in which reasonable behavior depends upon a reasonable understanding of the factors involved" (p. 50). The primary criterion in the evaluation of a choice is the degree of "intelligence" which informs it. It is how the subject structures his awareness of his problem that is crucial. Given the multiplicity of factors impinging on an occupational decision, it is essential that the subject be able to order and appraise them. It is this capacity for intelligent management of all relevant contents of awareness that Super calls "vocational maturity." The antecedents of Super's usage are found in Ginzberg, who says, "The key to the process was the maturity with which these several factors were handled by each age group" (p. 55).

Intensive study of the eight interview protocols for each age group persuaded Ginzberg and his colleagues that they could "recognize characteristic patterns for each age group" (p. 55), allowing them to hypothesize "the significant stages in the pattern of occupational choice as the individual matures intellectually and emotionally" (p. 56). They found that eleven-year-olds justified their choices from their likes and interests, whereas college freshmen considered their abilities and the barriers raised by the external environment in interaction with their interests and values. To these researchers, "the time axis is crucial" (p. 59). Their proposition is that a general pattern of development through stages prevails for males in our culture, although they admit that "there are large individual variations in progress toward maturity" (p. 59). Ginzberg's admittedly rough timemap looks like this:

Age	Period	Stage
6 - 11	latency	fantasy choice
11 - 13	preadolescence	
13 - 16	early adolescence	tentative choice
16 - 19	late adolescence	
19 - 25	early adulthood	realistic choice

The authors provide an excellent account of the general path of development in children and adolescents, based on the literature of childhood and adolescence as much as on their own data. They show that their hypotheses about maturation of occupational choice are compatible with the general psychology they review. One of the best points made is that a tentative occupational choice during adolescence is of considerable value to the youth as "a basis for current action" (p. 66), even though it may be unrealistic for the long haul. If the tentative choice helps to prevent the youth from floundering during his school years, that is something. Because of unsureness about themselves, many adolescents would seem to prefer to keep their occupational choices tentative longer than the structure of training and entry opportunities allows. They may be forced to commitments they realize are premature. One real problem with Ginzberg's data is that all his subjects were planning for college, which means that they enjoyed the freedom to remain in the tentative stage longer than other youth might be able to.

Under the press of reality and from the motives of a mature person, the young adult crystallizes his occupational choice, at the same time that he firms up his other life adjustments. Of course, not every person in the age range of 19 to 25 years achieves a firm and realistic occupational choice. The authors emphasize that the described stages are a model in terms of which a particular case history may be evaluated, but the striking aspect of a particular case may well be the ways in which it contradicts the model. The scientific value of the model depends on the expectation of a reasonable fit of the data from a majority of case histories of males in our cultures, so that this scheme provides a better framework for organizing data on development of occupational choice than does any alternative. Seen this way, the model has been remarkably serviceable.

Ginzberg further divides the tentative stage (p. 76):

Substages of the Tentative Stage

1. interest substage
2. capacity substage
3. value substage
4. transitional substage.

Although he hazards the assignment of ages to these categories, later investigations (Super and Overstreet, 1960; Gribbons and Lohnes, 1966) indicate that it is better to view these as a hierarchy of emphases which emerge on a unique timetable for each individual. There does not appear to be the regularity of timing Ginzberg suggests. He also subdivides the realistic stage (p. 95):

Substages of the Realistic Stage

1. exploration substage
2. crystallization substage
3. specification substage.

Again, the logic of the categories is convincing, but it would appear to be unwise to specify any set times for them. "Crystallization is the process whereby the individual is finally able to synthesize the many forces, internal and external, that have relevance for his decision" (p. 107). Clearly, this is an objective never attained by many people in our culture, and it is one which depends upon a high degree of intellectual rationalization. Ginzberg's favored subjects are such thinkers, but he hasn't the data from which to generalize to all young, male adults in our society. Specification involves closure on the details of a desired placement and tactics to obtain it, after crystallization of an occupational choice.

The main point in a proper appreciation of Ginzberg's stages and substages is to be clear that they provide an analytic model, not a prescription. Ginzberg's claim is solely this, "The existence of these norms indicates that there is a discernible sequence in the way in which the majority of individuals act with respect to occupational choice." (p. 118) In fact, his data allow him to speak only of norms for a majority of upper-class, high I.Q., college planning or attending, eastern males of Protestant and Catholic religions. Later in the book, Ginzberg reports on a small number of interviews with lower-class males and some women, from which he discerns some important departures from these norms. The model is seen to be particularly inapplicable to young, female adults. (p. 175)

In summary, Ginzberg's theory rests on three elementary propositions:

1. "occupational choice is a developmental process";
2. "the process is largely irreversible";
3. "the process ends in a compromise". (p. 185)

Choice is a cognitive process which extends over some fifteen years, during which the individual matures in his perception of the many factors, intrinsic and extrinsic, that impinge on choice and in his ability to interrelate the factors and synthesize a solution. *All* factors require attention, but the most critical is the development of a system of values. "True crystallization and specification cannot take place until a clarification of goals and values has been made." (p. 223). *Occupational Choice* is rich in detailed insights, but its overriding importance stems from the major insight of its authors, that a psychology of careers must be a *developmental, cognitive* psychology.

Super and Associates

Late in his book, Ginzberg makes the suggestion that refined analysis of the stages, especially in the tentative period, "could be achieved by a continuing study of a group of individuals throughout the entire period of the decision-making process." (p. 193) In the very year that he published this suggestion, 1951, one of his Columbia University colleagues launched the field work of such a longitudinal study. The colleague was Donald E. Super, and the enterprise is known as the Career Pattern Study (CPS).

The longitudinal study of a single panel of subjects over a span of 20 years (from age 14 to age 35), as undertaken by the CPS, is a distinct improvement over the one-time interviewing of eight different panels of subjects at age intervals of two years as employed by Ginzberg. The first volume of a projected six-volume series on the CPS is titled Vocational Development: A Framework for Research (Super, *et al*., 1957). It lays down the theoretical position for the CPS, in which the major advance is in the delineation of stages and substages of vocational development.[1] Super has been more heavily influenced by the thinking on life stages of Buehler (1933). In fact, he adopts Buehler's five major stages intact (see Table 4.1), but then augments them with a series of substages that describe about the same progression of emphases and syntheses described by Ginzberg's model. The greater scope and detail of Super's model appears to stem from his concern to describe the entire process of *career*, whereas Ginzberg's focus was on the narrower issue of *choice*. However, the similarities outweigh the differences in the two models, once nomenclature clashes are resolved. Table 4.1, which is only slightly edited from Super (p. 40-41), is presented in detail because the present authors are pleased to adopt its rubrics as their own developmental model. We think, as does Super, that age norms are to be viewed only as guidelines, and we see value in adopting Ginzberg's nice concepts of crystallization and specification to qualify Super's two "trial" substages.

The expansion of theory over Ginzberg resides primarily in the incorporation of two dynamic constructs, that of the *self-concept* and that of *role-playing*. The former construct is taken from phenomenological psychology, where it defines the phenomenal experience of identity, that is, the person's systematic view of himself. Endorsing Ginzberg's emphasis on the contents of awareness, Super goes the further step to isolate that system within the phenomenal field which is "the self-as-inferred-by-self" (p. 47), and to hypothesize a vital function for this self-concept in the determination of vocational behaviors. Although methodological problems continue to hamper efforts to test hypotheses about the self-concept, it has enormous attractive-

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[1] Unless otherwise indicated, page references in the following discussion of Super's ideas refer to this 1957 volume.

Table 4.1: Career Development Stages*

I. Growth Stage (birth - 14)
   1. Fantasy Substage (4 - 10). Needs and key figure identifications are dominant.
   2. Interest Substage (11 - 12). Likes are the major determinant of aspirations and activities.
   3. Capacity Substage (13 - 14). Abilities are given more weight, and job requirements (including training) are considered.

II. Exploration Stage (age 15 - 24)
   1. Tentative Substage (15 - 17). Needs, interests, capacities, values, and opportunities begin to be synthesized.
   2. Transition (18 - 21). Reality considerations are given more weight.
   3. Trial - crystallization (22 - 24).

III. Establishment Stage (25 - 44)
   1. Trial - specification (25 - 30).
   2. Stabilization (31 - 44). For most persons, these are the creative years.

IV. Maintenance State (age 45 - 64)

V. Decline Stage (age 65 on)
   1. Deceleration Substage (65 - 70).
   2. Retirement Substage (71 on).

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*From Super *et al.*, (1957) p. 40-41, with editing and slight adaptation.

ness and utility as a collective descriptive category in career development psychology, whatever the final judgment of it as a dynamic construct may be. A psychology of careers has to account for the individual's organized view of himself.

The second addition, the construct of role-playing, helps Super and his colleagues to bridge from career as a process of psychological development to career as a process of socialization. Role-playing is hypothesized as the basic technique by which a suitable compromise solution is shaped over time in the vocational behaviors of the individual. It is largely through role-playing that reality-testing is accomplished. Many of the most critical environmental pressures are exerted directly by social agencies on the role-playing repertoire of the person, and are then internalized as he comes to understand the press he is reacting to. The existence of a natural sequence of role requirements in our culture is recognized by Super in the notion of vocational developmental tasks, which is a convincing adaptation of Havighurst's (1953) well known construct.

Thus, Super accepts and expands Ginzberg's theory. He broadens the criterion from occupational choice to career pattern. (Super, 1953) He makes it quite clear that career pattern is what he wants to account for when he speaks of it as "a data-organizing concept... rather than an explanatory principle." (p. 16) He refines the model of stages and substages, and introduces the hypothetically dynamic constructs of self-concept and role-playing. "The self may be viewed as what the person is, just as the role is what the person does." (p. 46) The theory is genetic, cognitive, and behavioral, in Super's hands. "The essence of development is progressive increase and modification of the individual's behavioral repertoire through growth and learning. This process occurs over time and is marked by sequential stages of increasing competence." (p. 36)

Incidentally, Super begins by acknowledging that trait-and-factor psychology of individual differences has been historically the major contributor to vocational psychology, and indeed that its applications have been so useful that they have encouraged the neglect of the genetic approach. (p. 6) He asserts that we still do not have the realization of the full potential contribution of trait-and-factor theory to career development theory. Project TALENT is, of course, essentially trait-and-factor research. A particular purpose of this monograph is to advance the integration of the trait and the genetic approaches to career development theory. Our bridge will be the self-concept construct, which emphasizes the importance of the individual's emerging awareness of his own trait-nature, properly schooled through directed self-study of objective appraisals and relevant research knowledge.

Before we pass on to consideration of Super's clarification of the construct of vocational maturity, we pause to quote his team's wise counsel on the avoidance of reification of ideas.

> In vocational psychology, methodological analysis might help, for example, to eliminate the odd metaphysics by which such concepts as vocational interests, aptitudes, and traits are often confused with real entities. Analysis of methodology would assist in correctly identifying these and other terms and statements of relationships as hypothetical constructs--abstractions to help organize observations and explanations of vocational behavior. (p. 19)

Perhaps the most noteworthy achievement of his mongraph is the elucidation of a construct named vocational maturity. One word dominates Chapter Four of the 1957 monograph, in which this construct is exposited. That word is "evaluation." Super is convinced that it is not enough to describe the vocational behaviors of an individual at a given point in time. These observed behaviors require evaluation for their "goodness" or "rightness" in the scheme of things. What is right and good is what serves to move the person closer to the goal of integrative vocational adjustment as an adult. This "criterion of long-term efficiency in attaining satisfaction of socialized goals" (p. 70) is not necessarily the same as statistical norms based on the average performances of peer groups. Vocational behavior which is right and good for an individual, in that it appears to enhance his potentiality for an excellent adult career adjustment, may be quite unusual behavior by the norms of the peer group. The observed vocational behaviors have got to be judged and rated or scaled for evaluated degree of vocational maturity. Here is a clump of nettles for the research methodologist. What agency is to perform these evaluations, by what techniques and according to what standards? Super has at least a partial solution to his problem.

First, he does not entirely discount a statistical normative approach. Research should be able to establish statistically normal ages for passage through the sequential stages and substages of the developmental model, verifying or correcting the hypothesized ages presented in Table 4.1. The same research should establish a list of conventional vocational developmental tasks for each substage of each stage in the model. Then, on the basis of the actual tasks an individual is observed to be working on at a given chronological age he can be placed in the model. "Actual life stage in relation to expected life stage provides one basis for judging vocational maturity." (p. 57) However, the evaluation of the resulting discrepancy score is not simple or easy. It is not necessarily bad for an individual to be "retarded" in his stage of development, nor necessarily good for him to be "advanced." The person making a slow passage may be making a sure one, and the accelerated person may be winging toward disaster. The much more important consideration is how well the person is coping with the developmental tasks of the particular stage he is at, and how thoroughly he has resolved the problems posed by the developmental tasks of the stages he has already passed through. What really needs to be evaluated are the qualities of the behavioral repertoire the person has developed, relative to the demands of the tasks at hand.

Super defines a set of dimensions of vocational maturity which may be common traits for American males in the exploratory stage of development. These are "qualitative categories of vocational behavior within which there are quantitative variations associated with "age." (p. 59) Presumably it should be possible to construct measurements of these dimensions:

1. Orientation to vocational choice
    A. Awareness of the eventual need for choice
    B. Awareness of the factors to be considered in making a choice

    - C. Awareness of contingency factors
- 2. Information and planning about preferred occupations
    - A. Requirements for entry
    - B. Duties
    - C. Conditions of work
    - D. Opportunities
- 3. Consistency of vocational preferences
    - A. Consistency among choices
    - B. Consistency with abilities and interests
- 4. Crystallization of traits
    - A. Abilities
    - B. Interests
    - C. Attitudes
    - D. Values
    - E. Independence
- 5. Wisdom of vocational preference

We shall see that some progress in the scaling of this hypothetical trait syndrome has been made by Super _et al_., (1960; 1966), Gribbons and Lohnes (1964 a,b), and Crites (1965), but a lot remains to be done. Later in this chapter we argue that certain factors of the Project TALENT high school measurement battery can be interpreted as factors in the vocational maturity syndrome.

The criterion construct of integrative vocational adjustment requires some expositing. Super borrows elements of a model of a mature person from Baldwin (1955) and Shoben (1956). In this model, the vocationally mature person fully cognizes those aspects of the external situation which confront him as vocational development tasks. He selects a wise goal in the world of work, on the basis of self-insight into his crystallized psychological characteristics, especially his value system, and on the basis of reasonable compromise with reality. His subsequent behaviors are goal-directed and autonomous. The behaviors of this well-integrated adult are characterized by self-control, personal and social responsibility, the formation and use of ideals, and reasonable compromise. They lead him, with any decent luck, to satisfaction and success in his career. The vocational behaviors of his youth, adolescence, and early adulthood are to be evaluated for their contributions to the achievement of this criterion adjustment. Behaviors at any stage of development that prognosticate a seasonable arrival at this state of integrative vocational adjustment are vocationally mature behaviors for that stage.

A separate chapter (Chapter Five) of Super *et al*. (1957) discusses career patterns in a very general fashion. What emerges is that the career pattern is an abstraction of the work history of the individual, in which the sequence of jobs aspired to and later actually held is coded for field and level, according to some, unspecified scheme for organizing occupational titles; and that a tremendous variety of personal and environmental factors (listed in a table) presumably influence the career patterns. There is the slightest suggestion that career patterns may follow an inherent rule to some extent (p. 73), a notion which Super later expanded upon (Super, 1963), and which has led to efforts to fit Markov chain-type probability models to career pattern data (Lohnes, 1965; Gribbons, Halperin, Lohnes, 1966). On the whole, considering the title of this research project, the theoretical position developed in this initial monograph is surprisingly little concerned with the construct of career pattern. The real concern of Super and his colleagues appears to be with career adjustment in its psycho-social aspects.

In summary, Super agrees with Ginzberg that career development is a continuing process, largely irreversible, and requiring compromise. Ginzberg's focus on choices has been broadened to an interest in all vocational behaviors, of which choices are but one class. Self-concept expressing and role-playing behaviors have been posited as significant classes of determinants, or independent variables for career research. Perhaps most important is the exposition of a dependent, or criterion, set of variables as the class of dimensions of integrative vocational adjustment. The basic research paradigm which emerges is to scale the independent variables as dimensions of vocational maturity by relating them to the dimensions of the criterion. It would seem that the statistical model for operationalizing this paradigm in data analyses will be canonical correlation.

They indicate at several points that they will have to consider the general field of multivariate statistical procedures. (p. 86 & 95) The crux of Super's theory is the proposition that as the young person works through a sequence of vocational developmental tasks, "patterns of behavior become differentiated and integrated into repertoires of habits and skills" (p. 90) that may be judged for degrees of vocational maturity according to the extents to which they prognosticate emergence as an integratively vocationally adjusted adult.

Super is very instructive on what data should be collected in a longitudinal study of careers, and why. Although he is alert to the centrality of methodological problems at the present position of career psychology, he offers little guidance on methodology for a longitudinal study.

Super and his colleagues (1960) reported on the initial data collection for the Career Pattern Study, in a book titled The Vocational Maturity of Ninth Grade Boys. The data for the study derive from a group of 105 boys, who were all the boys in the ninth grade class in a small-town New York high school for whom reasonably complete protocols could be assembled. The data were collected in the 1951-52 school year by means of extensive interviewing and testing. It took three years for two typists to transcribe the tape-recorded interviews! The most interesting thing about the panel of subjects is that the age range was 12 1/2 years to 17 1/2 years, with a modal age of 14 years. The ninth grade appealed to the authors as a beginning point for a 20-year longitudinal study because it is the grade in which the youngster is required to make his first clear, public career decision, namely the choice of a high school curriculum. Super hoped to answer the research question of whether youngsters in general were adequately prepared, or sufficiently vocationally mature, to make such a crucial decision. As a result of the data analysis in this study, he concludes that at least fifty percent of youth are not ready to make a wise choice of curriculum in the ninth grade.

This first empirical study of the CPS series (Super et al., 1960) is essentially a scaling research. The problem is to devise, test, and refine some techniques for measuring dimensions of the vocational maturity syndrome as it exists in ninth grade males. Through extensive seminar effort, and with considerable ingenuity, the research team created 20 scales in the areas of the five previously described hypothetical dimensions of vocational maturity (VM). Super refers to these as "a priori" (p. 116) quantifications of constructs to emphasize the role of prior hypotheses, and gives the following account of how the seminars did their work. "In the process, transcribed interview protocols were examined in order to obtain actual examples of the kinds of behavior believed to illustrate each type and level of vocational maturity in the ninth grade and to make sure that appropriate data would be available in the interviews." (p. 37)

The monograph reports five kinds of studies on the ninth grade data:

1) reliability studies for the 20 VM scales,
2) score distributions for VM scales,
3) studies of the intercorrelations among the 20 VM scales,
4) studies of the intercorrelations among a set of 28 other measures on the subjects and their environments collected concurrently (these termed "correlates of VM"),
5) studies of cross-correlations between the six "best" VM scales and the 28 correlates of VM.

The reliability studies are a dramatic demonstration of the difficulty of settling on a conclusive concept of the reliability of scales such as these. About all the score distributions for the VM scales do is to show how the judges used the score categories. Presumably these polygons tell more about the behavior of the judges than the behavior of the subjects. The third class of studies reveals that for the most part the 20 VM scales do not cluster together. This analysis leads Super to select a subset of six scales that do have significant intercorrelations (the largest being .57, the median .37, the least .06), which he says "seem to measure two dimensions of vocational maturity in the ninth grade: orientation to choice tasks, and use of resources. The orientation dimension contains five indices, the use dimension only one." (p. 60) For the 14 other scales, he concludes that "the lack of relationships among these measures casts doubt on their construct validity." (p. 61) Super's concern over the interpretation of the modest correlations among the selected six scales lead him to intercorrelate the 22 items the six scales are based on and to factor analyze these intercorrelations. The principal factor extracts about 20 percent of the interitem variance. The other factors are practically negligible. From all this data analysis, Super concludes, or at least strongly implies, that only one important dimension of vocational maturity has been established for ninth grade boys. This dimension "is primarily orientation to the need to make educational and vocational choices, including acceptance of responsibility for choosing and planning, and a planning and information-getting approach to the orientation and choice process: it is, essentially, planfulness." (p. 150) His operationalization of this dimension is a Vocational Maturity (VM) Total score, based on adding up the scores on four scales that cluster most.

Scale 1: Concern with Choice
Scale 2: Acceptance of Responsibility for Choice and Planning
Scale 3: Specificity of Information
Scale 4: Specificity of Planning

In retrospect, it is easy to say that it might have been better to avoid combining items into arbitrary scales entirely, and instead to have intercorrelated and factor analyzed the total pool of items. One needs to remember that a dozen years ago behavioral scientists were not as thoroughly "computerized" as they are today. There may yet be a doctoral dissertation for one of Super's students in such a reanalysis of these dtaa, now that factor scores can be readily computed.

The set of 28 correlates of VM breaks down into 16 presumed predictors of VM, six achievement variables, and six additional variables. The presumed predictors include intelligence, socioeconomic status, and several family scales. In the cross-correlations with the six best VM scales, the largest correlation coefficient out of 168 of them is .40! Most of the coefficients are negligible. Super wonders if the entire system should be corrected for attenuation, but that does not make sense in light of the difficulty in defining doubt on their construct validity." (p. 61) Super's concern over the interpretation of the modest correlations among the selected six scales lead him to intercorrelate the 22 items the six scales are based on and to factor analyze these intercorrelations. The principal factor extracts about 20 percent of the interitem variance. The other factors are practically negligible. From all this data analysis, Super concludes, or at least strongly implies, that only one important dimension of vocational maturity has been established for ninth grade boys. This dimension "is primarily orientation to the need to make educational and vocational choices, including acceptance of responsibility for choosing and planning, and a planning and information-getting approach to the orientation and choice process: it is, essentially, planfulness." (p. 150) His operationalization of this dimension is a Vocational Maturity (VM) Total score, based on adding up the scores on four scales that cluster most.

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> Vocational maturity in the ninth-grade boys studied was associated with 1) living in an intellectually and culturally stimulating environment, 2) having the mental ability essential to respond to that environment, 3) responding to these stimuli by aspiring to occupations at higher rather than lower socioeconomic levels, and 4) achieving in one's activities. (p. 147) ... Vocational maturity in ninth-grade boys appeared not to be related to age within the grade group, to birth order, to religious affiliation, to family aspirations, to acceptance by peers, or to personal adjustment. (p. 148)

From all this, Super draws two main recommendations for schools. First, "curriculum approaches which foster planfulness would appear to be most appropriate." (p. 151) Second, "The task of the vocational counselor in the ninth grade is essentially a matter of furthering vocational development rather than of fostering specific vocational choices." (p. 158)

What is the contribution of this monograph to the testing and refining of the theory of career development? Super doesn't say so, but is seems that the greatest contribution of this empirisicm to the theory is to contravert the assignment of even tentative ages to the stages and substages of the model. The research subjects have an age spread of five years, yet age within grade is not related to vocational maturity. What we seem to have is a clear indication that during the school years grade in school is more potent than age, and it would seem to follow that grade norms rather than age norms should be developed for the first two stages and their six substages. At any rate, finding considerable variance in vocational maturity among ninth grade boys, and then finding that variance being unrelated to age, is of major theoretical and practical importance. It means that career psychology will have to be as much a psychology of individual differences as a psychology of developmental trends. The finding that vocational maturity at the ninth grade level is essentially planfulness, rather than goal-attainment or consistency or realism of preferences, corroborates the construct of developmental tasks and localizes the normal tasks for boys at this grade level. We shall see that in the light of this finding Gribbons and Lohnes (1965a) have called their set of vocational maturity scales for eighth and tenth grades "Readiness for Vocational Planning." Finally, Super's methodological difficulties serve to emphasize the central need for methodological breakthroughs in career research on adolescents.

At the American Personnel and Guidance Association Convention in Washington, D. C. (April, 1966) Super and his associates presented 12 papers in four symposia on the fifteen-year history of the Career Pattern Study. At this time the CPS staff discussed preliminary follow-up results, in detail for the twelfth-grade follow-up and sketchily for three-years-out-of-high-school data collected in 1958 and seven-years-out data collected in 1962. CPS has been very successful in maintaining contact with its subjects for ten years, so that is now has very detailed and fairly complete data files. In fact, the staff would seem to have more data than it can keep abreast of, but this embarrassment of riches will allow an almost limitless amount of retrospective checking of new hypotheses and hunches.

Martha B. Heyde reports on factor analyses of 80 vocational maturity indicators as scored in grade 9 and in grade 12. She shows that there is considerable similarity between the structure of 24 major factors from the 80th-order ninth grade correlation matrix and the structure of 25 major factors from the corresponding matrix for the twelfth grade, as revealed by scanning the two structure matrices. She doesn't report the two structures, but merely lists the assigned names for the factors, so the reader has only the choice of taking or rejecting her testimony to the effect that "18 factors with similar structure appeared at each grade level." (p. 5-4) Ten of these are said to be occupational information factors, two were planning factors, two were based on wisdom measures, and one each was related to independence of work experience, specificity of preference, implementation of preference, and awareness of family obligations. The CPS staff thought highly enough of these analyses that they scored the subjects on these sets of 24 and 25 factors and used these VM factors as predictors of other variables. Yet the Symposia are curiously silent on the vital issue of cross-correlations between the ninth and twelfth grade factor scores. Heyde's assertion that "the factor structure of the presumed vocational maturity measures is thus seen to be remarkable similar in grades nine and twelve" (p. 5-5) is so crucial for the construct of vocational maturity that is will require more precise testing than it has received.

It is interesting to note that 15 years after its start the CPS is still searching for rubrics for vocational maturity. CPS has been known all along as pioneering, exploratory research, but the Symposia makes it crystal clear that the research is essentially a measurement project and that the search is for conceptually and operationally adequate dimensions of vocational maturity. The empirical successes and failures of the CPS have been with good and bad VM scales. Our perspective of the CPS is that it is an effort to create a trait model for the domain of vocational behaviors. Super wants to specify, conceptually and operationally, a particular syndrome of traits that are relevant to careers, to study their emergence over time, and to discover their forward perdictive validities for career criteria and for each other. The heavy reliance on correlation techniques, including cluster analysis, factor analysis, and multiple correlation, at CPS is implicit endorsement of this view of the enterprise, because correlation is the mathematical model for trait-and-factor theory. When Super and his colleagues use analysis of variance techniques to study group changes in VM over time their work is least convincing, because we suspect that they are studying how judges respond differently to age-differentiated data sets. The most we can say is that the judges perceived the responses of the group to be at different levels at different times. It is the covariances among the scaled data that seem more interesting than the means and variances.

No research into an area of human psychology where individual differences are as extensive and important as the CPS has shown them to be in the area of careers can afford to carry more variables than it does subjects. In a long-term longitudinal study such as the CPS it is inevitable that a very large number of items of information will accrue. The point is that observational data, which we call "indicators," are not themselves research variables. Variables are formed out of combinations of items. If a set of items can be shown to "scale" a trait or a factor, then the more items combined into the set the better for reliability's sake. Given the order of the CPS's N, it would seem that somewhere between one and a dozen dimensions of vocational maturity would provide a suitable number of predictor variables for a theory of career development. Actually, in his first research report Super (1960) chose six VM dimensions for his model.

No particular trait model can be "right" for the CPS data in a way that will make all other models "wrong," but we do believe that a model can be judged to be wrong for these data if it carries more variables than the number of subjects warrants. We think that the CPS team should carry along several promising trait models for the domain of vocational behaviors, until it may eventually be possible to pick out the "best" model. The main thing is that the competing models should be kept sorted out, and each model should be of suitable complexity (or perhaps, we should say simplicity) for the task at hand. We like the six-trait model of the 1960 monograph and wonder why it has been dropped in the follow-up studies. We like Heyde's notion of establishing a model with the rubrics of orthogonal factors even better, although it is not clear that she has the best factoring for the job. Our suggestion is that more effort be put into scaling the ninth and twelfth grade data in a way which will provide a parsimonious trait model of vocational maturity which Super might then designate as the "official" model. Past, present, and future staff members will then want to propose alternative models. The multivariate statistical design for testing a given criterion hypothesis for the official model will probably be the right design for testing the same hypothesis for each of the competing models, so that a routine will be established within the research program.

Surveying the literature on Scientific Careers and Vocational Development Theory, Super and Bachrach (1957) concluded:

> Research has been based largely on trait-and-factor theory, derived from the psychology of individual differences and from a static approach to social factors. (p. 6) There is thus a lack of perspective on the dynamics of development viewed longitudinally. (p. 7)

They even term the trait-and-factor approach the "classical" one, a usage in which we concur. It is important to note that neither Ginzberg and associate nor Super and associates have abandoned the classical trait approach. What they have attempted is to marry it to a developmental approach. They have tied research to the stages and choice points of a developmental model. "Prediction should be directed toward the next stage rather than to a hypothetical 'final occupation.'" (p. 103) This marriage of trait and developmental psychologies was badly needed, and is itself an enormous contribution. By concentrating also on the subject's cognitive contents and processes, his awarenesses and his self-concepts, these theoreticians have merged another vital approach to career psychology, which we will consider in Chapter Five. It is perhaps appropriate that research teams with access to norming data such as TALENT represents should concentrate on refining the trait-and-factor aspects of career theory. Super and Bachrach provide a specific charge for TALENT-type research, and one which we try to discharge later in this chapter, when they call for research which

> will require a more functional type of occupational analysis, providing both a broad grouping of occupations in terms of basic functions and also a detailed description of tasks. The former will permit the determination of personal traits and experience variables related to success and satisfaction in a broad field of work. The latter will help the young person to obtain a more realistic understanding of the nature of the occupation under consideration and will facilitate the more specific choices which occur during the later stages of occupational life. (p. 103)

Ginzberg and Super have created a theoretical context for a large-scale, national, longitudinal research on career development such as Project TALENT. Now it is appropriate for the empiricism to flesh out and modify the theory.

Other Researchers

Before reviewing the previously published Project TALENT research on careers, we will look briefly at a few other research enterprises that have influenced our thinking about career development.[1] One of these is a small-sample longitudinal study initiated by Warren Gribbons in 1957 (Gribbons, 1964; Gribbons and Lohnes, 1964a, 1964b, 1965, 1966, 1967), with the title "Career Development Study" (CDS). This study resembles the CPS, from which it drew its inspiration, in many ways, and has been described as a replication of the CPS. However, the 110 subjects of the CDS are equally split between males and females, and although extensive interviews have been conducted with the subjects at two-year intervals since 1958, the CDS has collected substantially less data per subject than has the CPS. The focus of the CDS has been on scaling vocational maturity traits from eighth- and tenth-grade interview protocols, and exploring concurrent and follow-up predictive validities of the resulting "Readiness for Vocational Planning" (RVP) scales. Perhaps the major way in which the CDS differs from the CPS is in the thorough dependence of the former on multivariate statistical methods of data analysis. The multiple group discriminant functions procedure has been the basic analytic tool of the CDS. This salient feature of their research style reflect the methodological emphases of their professors, D. V. Tiedeman and P. J. Rulon, at the Harvard Graduate School of Education. With the data-organizing capability of this multivariate method the CDS authors have succeeded in displaying considerable predictive validities for their eighth-grade RVP scales. These scales reflect the same elements of planfulness contained in the CPS's ninth-grade vocational maturity scales.

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[1] Tiedeman's theoretical contributions have also greatly influenced our work, and these are considered in Chapter Five.

Even with its focus on VM measurement, the CDS continues to be plagued with scaling difficulties. Its tenth-grade RVP scales have not worked well, and the authors have yet to scale dimensions of VM from their twelfth-grade or two-years-out-of-high-school data sets. Their continuing struggle with these scaling issues confirms that it is easier to call for an expansion of the established inventory of personality dimensions organized by trait-and-factor psychology than it is to deliver new dimensions. The more convinced career researchers become of their field's need to augment the established list of measurement traits with new dimensions in such construct areas as vocational maturity, self-concepts, sense of agency, problem-solving strategies, goal-directedness, values hierarchy, etc., the more they will have to structure their research programs as measurement research.

Two of the prominent figures in career psychology seem to have accepted this direction for their work. Without going into details on their very different approaches, we observe that Crites (1965) has concentrated on producing group-administered, objective scales for aspects of VM, while Holland (1962, 1963, 1966) has attempted to scale the approximations of personalities to six ideal types, somewhat along the methodological lines of the Allport-Vernon-Lindzey Study of Values (1951).

Anne Roe has contributed to the psychology of career development on a very broad front. She has authored several intensive efforts ranging from a description of what careers look like to the dynamics of how career behaviors are motivated and shaped. For example, where most researchers have been satisfied to employ interest inventory scores as independent variables, Roe (1956) has insisted that "a satisfactory theory of vocational choice must depend upon a better understanding of the origin of interests." (p. 271) Roe has developed a theory to explain how early childhood experiences, such as birth order among siblings, may influence later vocational behaviors. She and her students have had tough going in their efforts to research the theory, but their quest for the etiology of career behaviors is most commendable. Roe has accumulated evidence for one generalization which we have applied in our development of the Career Development Tree. "Apparently one of the earliest differentiations, if not the first one, in orientation of attention is between persons and non-persons." (p. 319) This observed polarization of interests in childhood is built into the tree structure as the first branching, presumably occurring in males around the fifth or sixth grade.

Roe (1964) has seen clearly the need to tie a theory of career development to a general theory of personality, for the sake of both enterprises. "Personality is not an independent variable, or occupation a dependent one in any strict sense (although the relationships may tend this way)." (p. 198) First personality shapes vocational behaviors, but in later life the press of occupational circumstances impinges upon personality. Roe uses Maslow's (1954) theory of a hierarchy of prepotent basic needs:

1. physiological needs
2. safety needs
3. belongingness and love needs
4. importance, respect, self-esteem, and independence needs
5. information needs
6. understanding needs
7. beauty needs
8. self-actualization needs

She finds here a position on personality dynamics that can help her to generate hypotheses about the origins of vocational behaviors. For example, if the framing of adequate self-concepts is a vocational developmental task for the Tentative Substage of the Exploration Stage (modal age 15-17), no subject who has not achieved approximate equilibrium with respect to needs in levels one through five, however temporarily, can be expected to cope with this developmental task. The point is that there is a process of general personal development that parallels the career development process in a life history, and the two processes are intertwined. It is an analytical act of the scientist that separates them. Roe (1964) has also surveyed the situation in the field of etiology of career behaviors. "There is sparse evidence that both specific and general early experiences may be related to later vocational choices, but research in this field has barely begun and has not thus far touched upon the mediating mechanisms in the determination of choice." (p. 212)

Roe (1964) has framed for career psychology its most useful taxonomy of occupations to date. (p. 151) This is a two-way classification with 48 cells formed by the intersections of six levels of function and eight groups of primary focus of activity.

Roe Occupational Levels

1. Professional and Managerial 1
2. Professional and Managerial 2
3. Semi-professional and Small Business
4. Skilled
5. Semi-skilled
6. Unskilled

Roe Occupational Groups

1. Service
2. Business Contact
3. Organization
4. Technology
5. Outdoor
6. Science
7. General Cultural
8. Arts and Entertainment

In longitudinal career researches such as the CPS and the CDS an attractive mode of analysis has been to trace the path of movement over time by each subject through the cells of the Roe lattice. Gribbons, Halperin, and Lohnes (1966) have even been able to fit Markov probability models to the CDS data of this sort. Nevertheless substantial uneasiness has accumulated in researchers around the issue of whether the cells of the Roe lattice provide the most discriminable criterion variable for studies of the predictability of occupational choices and placements. It is not that research results have not been positive. As Roe (1964) says, "The assumption that there are differences in various aspects of personality between those following different occupations has been upheld whenever it has been subjected to research." (p. 211) This is true regardless of the method of grouping occupations employed. The problem is that sharp predictability is seldom obtained. "Differentiations have been shown, but the typical personality pattern is never a universal one for the members of any group. All predictions of occupational choice are necessarily probabilistic." (p. 211) Roe goes on to say that the critical probabilities will be disconcertingly small in any case. Holland (1964) makes the same point when he says of such studies that "the magnitudes of the obtained relationships are often of little practical value." (p. 277)

One explanation for lack of precision in predictions from trait profiles is, of course, that "personality is only one broad factor in the decisions made at any occupational choice point." (Roe, 1964, p. 211) There is a natural limit to the potency of a particular set of independent variables relative to a given criterion, but the extent to which this limit is approached in data analysis is in part a function of how the criterion is scaled. In reporting our Project TALENT research, we shall try to show that a more predictable taxonomy of occupations than that afforded by Roe's lattice can be framed, and that its cells can be given construct validity as the branch tips in a tree structure of careers. This new taxonomy is derivative from Roe's, however, in that Roe's concepts of fields and levels have been most influential in the shaping of it and are clearly discernible in it.

Roe (1964) has given considerable thought to the meaning of careers for American women, and has indicated that "studies of occupational histories for men and women may require different concepts. It may well be that occupational classifications, too, should be different for the two sexes." (p. 212) Super has faced this issue, and has augmented four of Miller and Form's (1951) types of career patterns for men by hypothesizing seven types of career patterns for women. (Super, 1957, p. 77-78)

Career Patterns for Men

1. Stable (early decision, no trial period)
2. Conventional (initiation; trial; stability)
3. Unstable (trial; stable; trial)
4. Multiple Trial

Career Patterns for Women

1. Stable Homemaking
2. Conventional (work; homemaking)
3. Stable Working (as for Men)
4. Double-Track (joint work and homemaking)
5. Interrupted (work; homemaking; return to work)
6. Unstable (as for Men)
7. Multiple Trial (as for Men)

In dealing with their mixed sex sample for the CDS, Gribbons and Lohnes are finding it necessary to separate the women whose career focus is on homemaking from the women who value a career in the world of work outside the home much as men do. In the Project TALENT research on career development, we have similarly concluded that career analysis needs to be differentiated for the two sexes. The Career Development Tree to be reported is based on and applies to males only, and a parallel sciencing operation on the careers of the TALENT females remains to be done. It is interesting that Super finds the career process to be more complex in women than in men, which confirms the general impression of the fair sex.

Another research that has quite understandably influenced this monograph is the Scientific Careers Study (SCS) (Cooley, 1963). The SCS included 700 boys and young men at five different age levels in eastern Massachusetts for a five year period. The sampling frame was an overlapping age-groups design that allowed the formulation and testing of hypotheses for the range from grade 5 through grade 20, thus seeing some of the subjects through the Ph.D. A broad range of behavioral trait and environmental measures was employed as the predictor base, and course career groups comprised the criterion. For much of the data analyses a four-cell classification of career aspirations or career placements (in older youth) was employed.

Four-Group Career Criterion

1. Potential Scientist Pool (PSP)
2. College - Nonscience (CNS)
3. Noncollege - Technical (NCT)
4. Noncollege - Nontechnical (NCNT)

The construct validity of this coarse grouping of occupational aspirations or placements resides in a theory of the career development process which holds that the actual major decisions required of youths in the Growth and Exploration stages can mostly be made with an awareness of the world of work phrased in these gross rubrics, so that decisions requiring awareness of more detailed occupational categories are subordinate decisions. We will argue this position fully in Chapter Five, when we review and apply Tiedeman's extensive work on the processes of differentiation and integration in vocational decision making. This fourfold grouping is also an example of a predictable criterion, as the SCS empirical results demonstrate. Later we will see that this four-group criterion has been incorporated in the new Career Development Tree as the second level of branching, by adding the college-noncollege branching to the people-thing branching at the first level.

A fundamental proposition in this study of scientist-development (Cooley, 1963) is that "the differences among individuals which result in different choice behaviors can be adequately described by locating individuals as points in a multidimensional behavior space." (p. 17) This approach posits that career behaviors are primarily a function of personality traits. It does not put the emphasis on cognitive awareness directly, although in actuality most of the traits of ability, interest, and disposition that were measured on the SCS subjects are dimensions of cognitive content and functioning. The SCS trait model of personality seeks a comprehensive appraisal of the cognitive field without special focus on self-concepts. It is very much the classical trait model of the psychology of individual differences. The SCS also collected data on several environmental variables, which "in part determine location in the behavioral space and also affect choice directly." (p. 17) The SCS subscribed to the position of Super (1957, 103) and Roe (1964, 212) that prediction equations should be developed only for the gap from one choice point to the next, and not for long-range outcomes. In this research there was no attempt to relate the whole trait profile of subjects to career behaviors. Rather, the concentration was on comparing the predictive efficiencies of various subsets of predictors at each grade level. The results are particularly illuminating in the uselessness of expensive projective test data (Rorschach; Thematic Apperception Test) they disclose. In most other respects the findings substantially validate the trait syndromes employed, and reveal interesting and useful patterns of central tendencies for the criterion groups. The positiveness of the SCS prediction studies testifies to the utility of the data analysis strategy, in which the key methods are discriminant analysis and classification probabilities. This study bears out Roe's dictum that "the most appropriate predictive model is a multivariate one in which all of the appropriate factors can be combined in various weightings." (1964, 212) In our research at Project TALENT, we have had the benefit of a sample of subjects and a sample of traits large and representative enough to permit an unparalleled test of this approach.

We have seen that Super calls the trait model the "classical" approach, and that he, too, has indicated the requirement of a multivariate statistical methodology. His desire to see the developmental and multiple traits approaches wedded is apparent in this statement:

> What traits and factors determine the sequence of jobs in the career pattern, and how do they account for the frequent deviations from the normal pattern for a given socioeconomic group? This is the question of the role of intelligence, special aptitudes, interests, and personality traits. It has been studied in other connections by many psychologists, but rarely as a multivariate problem and never in relation to career pattern theory, only in relation to questions of vocational choice and success. (1957, 79)

Super is, however, essentially ambivalent toward trait psychology and its multivariate statistical procedures. On occasions he suggests that there may be some other, "thematic-extrapolative" (1957, 282) method that will prove superior to the "actuarial" method for synthesizing career predictions from known determinants, if only the appropriate mathematical model for the new procedure can be found. Super and Bachrach (1957) assert that the approach of the Career Pattern Study "hypothesizes that a better prediction of vocational behavior can result from the analysis and extrapolation of behavior patterns than solely from the actuarial use of trait-and-factor data." (p. 92) To date the CPS has shown no empirical result to justify this hypothesis, but at the suggestion of Super and Tiedeman, Gribbons, Halperin, and Lohnes (1966; see also Lohnes, 1965) have experimented with the fitting of Markov-type probability models to career patterns in the data of the Career Development Study. The Markov chain model posits a stationary set of transition probabilities which are supposed to describe the proportions of subjects making each possible move between levels of the criterion variable at each decision point, regardless of which stage of decision-making is under consideration. This is a very simple, highly abstract, and not very realistic model for the career development process. Its advantages are that it is mathematically tractable and is well known among scientists. Markov chain analysis is obviously the right approach for a first try at the kind of "thematic-extrapolative" analysis of career patterns Super wants to see, although experience will no doubt show that more complex and difficult models are required. Some fairly convincing Markov chains have been fitted to CDS career criteria, but the authors have yet to demonstrate the predictive validities of their models, or to compare these validities with discriminant analysis validities. Gribbons and Lohnes are now processing a new set of follow-up data collected in 1966-67 which provide criterion information for such comparative validity studies.

A new methodology for career psychology may well evolve during the next new years. Meanwhile, we need to make the best use possible of the methodology we command. Ten years ago Super asked, "How can the study of job sequences, of the interaction of traits and factors, and of perceptions of self and of occupations, be brought to bear simultaneously to provide a better understanding of the nature and determinants of career patterns?" (1957, 79). Our answer is implicit in the design of the Project TALENT studies reported in this monograph. Explicitly, it is that we need to apply systematically a coherent, sequential set of multivariate statistical procedures to our career development data. We call the strategy of data anlysis we favor multiple group discriminant analysis, after its major feature. We do not pretend that it is the only correct multivariate strategy for the task at hand, but we have carefully considered alternative strategies without finding what seemed to us a better one. It should be said that the strategy we now describe has evolved in our own research experiences and has never been static. We have learned its elements from and have been influenced in our ways of using them by more people than we can name, but we will specify a few sources. Rulon (1951a, b) and Tiedeman (1951, 1954) taught us the multiple group discriminant procedure, the choice of which characterizes our strategy. Tatsuoka (1957) introduced us to classification probabilities, and Geisser (1964) provided the method we now employ. The principal components and canonical correlation models came to us through Rulon from Kelley (1934, 1940) and Hotelling (1933, 1935). Our theoretic and synthetic view of the multivariate field we owe primarily to Anderson (1958) and B. G. Wingersky. Besides developing a multitude of algebraic ties among the pieces of the strategy, Wingersky developed the Project TALENT multivariate statistics program system for the IBM 7090 with which the authors have computed their analyses of TALENT data.

Table 4.2 outlines the research strategy. In the initial organization of the predictor data the strategy allows a factor solution for all subjects of a heterogeneous population (say, of both sexes and several school grades), by attributing the heterogeneity factors effects to the parameters of a linear model, and factoring an error variance-covariance matrix. (Lohnes, 1966, Ch. 2) This stage of analysis is the only one in which the factorial analysis of variance and covariance is employed, however. The criterion variables for the multiple group discriminant analysis is always a simple, one-way classification variable, and the sample of subjects, although hypothetically from different populations with respect to this variable, is to be relatively homogeneous with respect to those variables which are controlled in the design by random sampling alone. Notice that this strategy will permit the researcher to handle a two-way classification scheme, such as Roe's occupational lattice, by doing separate discriminant analyses on each way of classifying (as group and as level), or by stringing all the cells of the two-way lattice out into a one-dimensional classification (as Roe's 48 lattice cells). What it does not permit is a factorial design, with coordinate consideration of main effects and possible interaction effects. Computer programs for doing factorial discriminant analyses exist, but we believe that the conceptual complexity introduced when research has recourse to such a complex data analysis procedure warrants a continued effort to see what can be accomplished with simple, one-way vocational criteria. The hope is that obtained results justify this choice of research approach.

Previous TALENT Results

Chapter One reviewed Lohnes' (1966) factor models for the abilities and motives domains of the TALENT behavioral measurement space. This was a report on Stage One of the research strategy of Table 4.2. Chapters Two and Three have already reported a number of predictive validity studies for educational and occupational criteria that demonstrate Stage Two of the strategy. Before we present our new work on career criteria, we want to review some published results for such

Table 4.2: The Research Strategy

Stage One. Organizing the Predictor Data

1.1 Factorial MANOVA to account for sex and grade control factors as parameters of a linear model.

1.2 Principal components and varimax rotation on error variance-covariance matrix to produce a suitable reduced rank, orthogonal factors basis for the predictor space.

1.3 Score all subjects on factors.

1.4 Canonical correlation analyses of redundancies between predictor domain and other domains of continuous measurements for subjects (e.g., an environment measures space).

Stage Two. For Each Categorical Career Criterion

2.1 D^2 matrix (all two-group multivariate distance functions) for all initial categories of the criterion in the factor space. Inspection leads to combining adjacent categories and defining a derived criterion with fewer categories.

2.2 Multiple group discriminant analysis on derived categories in the factor space. Interpretive results include:

1) Manova and Anova F-ratios and all two-group T^2 values in reduced discriminant space

2) R^2, the squared canonical correlation, for each significant discriminant function

3) Correlations of each discriminant function with the predictor factors

4) Group centroids in the reduced, standardized discriminant space

2.3 Classification probabilities study on a replication sample, giving prediction hit rates for each group and overall.

criteria from the 1966 monograph entitled Project TALENT One-Year Follow-Up Studies.(Flanagan et al., 1966) These studies were not done in the derived metrics of the MAP factors, but it is not difficult to make loose translations of results into the new rubrics.

In Chapter 8 of that report, Flanagan compared the occupational aspirations expressed by subjects while in high school with their aspirations expressed on the one-year-out-of-high-school follow-up questionnaire. He gave data for four grades and both sexes, but we have selected his data for grade nine and grade twelve males as the basis for Table 4.3. Flanagan found that while in all grades of high school the largest percentages of boys were planning to be engineers, the great majority of these youths had changed their aspirations by the time of the follow-up. The remarkable trend in the table is the instability of occupational choices revealed. Only 17 percent of the ninth grade boys expressed the same choice four years later, and only 31 percent of the senior boys expressed the same choice one year later. (A similar picture emerged for females.) Flanagan further observes:

> When in high school about three out of four boys planned careers which required college training and only about one in four planned careers not requiring college training. According to current statistics, however, only one in four high-school boys can be expected to graduate from college. Therefore, it appears that at least half of the boys in high school had unrealistic career plans. (p. 174)

Seeing that occupational choices expressed in high school tend to be unrealistic and unstable, Flanagan concludes that educators "must develop a better program for helping the student to understand both himself and the various roles for which he might prepare himself." (p. 179)

In the chapter following Flanagan's, Cooley poses the question of whether the career plan changes of TALENT males are predictable from their personality traits as measured in the ninth grade. If such changes can be shown in the aggregate to be predictable consequences of different patterns of trait profiles, then high school students might be helped to anticipate the process of changing aspirations. Preliminary investigations indicated that the 30 occupational groups

Table 4.3: Occupational Aspirations of Males in High School and One Year Out, as Percent of Total Sample and Percent with Same Aspirations Both Times (12, 172, 175, 177)

	Ninth Grade			Twelfth Grade		
Aspiration Groups	1960 HS %	1964 FU %	% Same	1960 HS %	1961 FU %	% Same
1. Mathematician	1.9	.6	3	1.1	.5	17
2. Physical Scientist	4.6	1.8	10	3.0	1.9	28
3. Biological Scientist	2.7	1.6	3	1.4	1.3	14
4. Engineer	21.3	7.9	18	17.3	8.9	35
5. Physician	3.4	2.4	24	2.5	2.6	59
6. Dentist	2.9	.8	14	1.8	1.0	33
7. Nurse	.2	.0	3	.3	.0	5
8. Pharmacist	1.2	.5	8	1.6	.7	35
9. Psychologist, etc.	.1	1.4	10	.8	1.0	14
10. Social Worker	.8	.3	0	.6	.1	6
11. Clergyman, etc.	1.7	1.0	22	1.5	1.8	66
12. Government	.1	.8	3	.5	.7	11
13. Lawyer	3.3	2.5	17	3.4	2.7	36
14. Teacher; Librarian	3.6	8.6	24	7.5	8.2	49
15. Accountant	2.9	3.7	13	4.8	3.8	29
16. Businessman	3.5	10.6	32	7.8	7.7	26
17. Writer	.4	.5	6	.8	.7	46
18. Artist; Entertainer	1.9	1.9	14	1.6	2.0	39
19. Engineering Aide, etc.	1.5	4.3	4	1.0	4.5	9
20. Aviation	3.5	.5	3	1.9	.7	8
21. Medical Technician	1.3	.6	1	.3	.6	22
22. Office Worker	.7	2.1	4	.5	3.2	10
23. Salesman	.8	1.6	5	1.4	2.2	22
24. Armed Forces	5.8	2.9	3	6.0	2.8	12
25. Protective	1.4	1.2	8	1.5	1.2	24
26. Skilled Worker	5.5	8.6	20	7.6	8.2	33
27. Structural Worker	.7	5.0	8	1.4	5.1	29
28. Barber; Beautician	.6	1.8	6	.9	1.8	21
29. Farmer	5.4	2.5	20	4.3	3.4	44
30. Other; None	16.3	30.0	29	14.9	20.7	29
Overall Stability			16.8%			31.4%

used by Flanagan to study stability were too many to provide a predictable criterion, but that the four groups used in the SCS were too few categories for the large collection of TALENT follow-up data on ninth grade males. Dichotomizing each of the two college cells of that fourfold table results in the following six-category career plans classification (bracketed oocupational titles are examples not complete lists):

1. College Physical Science (physicist; engineer)
2. College Biological-Medical Science (biologist; dentist)
3. College Humanities (social scientist; teacher)
4. College Business (accountant; lawyer)
5. Noncollege Technology (skilled worker; laborer)
6. Noncollege Business (service worker; office worker)

Naturally, in such a coarse grouping plans appear to be more stable over the four-year period, yet only 42 percent of 5,857 boys studied remain in the same plans group when one-year-out aspirations are compared with ninth grade aspirations. Table 4.4 shows the distribution of stable and changed plans for this sample. The research question is whether a scheme for predicting position in this table can be developed from trait profiles measured in the ninth grade.

Just as in the Scientific Careers Study, the trait predictors are analyzed in separate packages:

1. 19 ability scales;
2. 10 temperament scales; and
3. 17 interests scales.

The relative predictive validities of the packages can then be determined. Although a valid discriminant function was obtained for the 36-cell change matrix from all three bases, the most powerful scheme is based on the 19 ability tests, which is worth reviewing in detail.

The predictive power of the 19 ability tests for the 36-cell criterion is pretty well summarized in two discriminant functions, one of which is a general intelligence factor, while the other is a measure of mathematical-technical capacity that is uncorrelated with general intelligence as here defined. A "map" of the 36 groups in the plane of these two abilities discriminant functions displays the predictive validities. That map is reproduced as Figure 4.1. In

Table 4.4: Distribution of Stable and Changed Career Plans over Four Years for TALENT Ninth-Grade Males (12,183)

Ninth Grade Plans (1960)		Follow-up Plans (1964)						Ninth Grade Totals
		PS	MB	HU	BC	TE	BNC	
PS	(College Physical Science)	965	291	378	545	121	79	2379
MB	(College Medical-Biological)	106	377	173	213	29	37	935
HU	(College Humanities)	49	47	261	120	36	19	532
BC	(College Business)	57	50	140	440	24	39	750
TE	(Noncollege Technology)	94	28	67	97	316	128	730
BNC	(Noncollege Business)	36	27	72	178	93	125	531
	Follow-up Totals	1307	820	1091	1593	619	427	5857

THE 36 CENTROIDS IN THE ABILITY SPACE

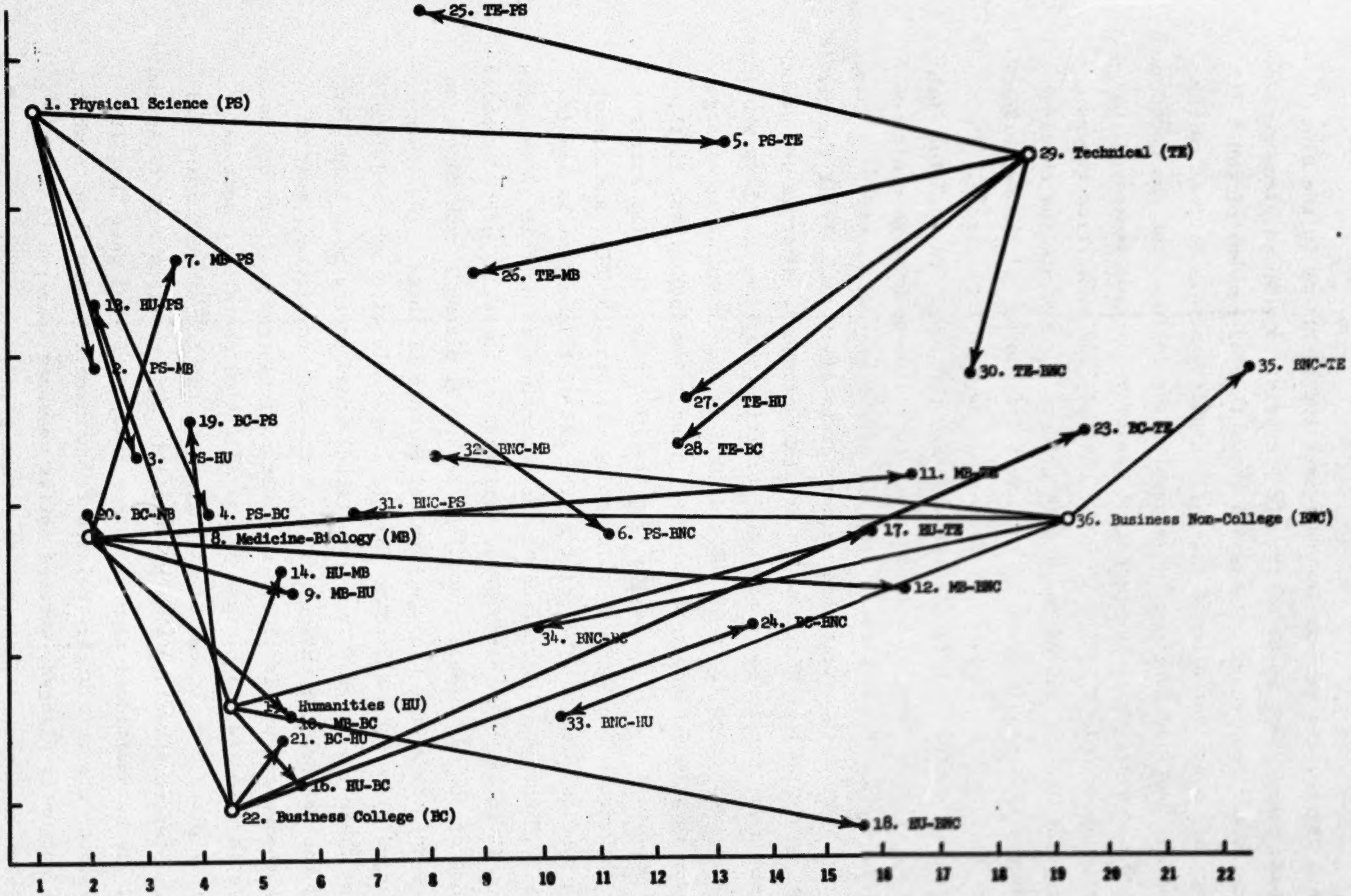


Figure 4.1: From Figure 2 in Appendix I of One-Year Follow-Up Studies

this figure, the six circles represent the locations in the ninth grade measurement space of the six groups of boys whose plans remained stable for four years.. Table 4.4 shows that 42 percent of the 5,857 boys are distributed among these six stable groups. Notice how the general intelligence function separates the college from the noncollege stable groups, while the technical capacity function separates the science-technology groups from the business and humanities groups. Now look at just one of the stable groups, for example the Physical Science (PS) stable group in the upper left corner of the map. There are five arrows, or vectors, radiating out from this circle. The leftmost vector goes to a point that has the label "PS-MB," for "9th grade college physical science plans to follow-up college medicine-biology plans." the point at the end of the vector identifies a change group. Now notice that this vector points almost exactly at the circle for stable College Medicine-Biology (MB) planners. What we see demonstrated is that in terms of their abilities profiles, the boys who left the PS cell to go to the PS-MB cell are in the direction of a target group they resembled, the stable MB group. Now look at the fifth, or uppermost vector radiating from the PS circle. It aims straight at the circle for Noncollege Technological stables (TE), and almost reaches its target. The point at the end of this vector is labeled "PS-TE," and is the location of the centroid for the cell of changers from PS to TE. The ninth grade abilities of these 121 boys resembled those of the 316 stable Noncollege Technical planners much more than those of the stable College Physical Science planners. They have changed plans in a direction that is compatible with and predictable from their abilities. This directional trend pretty much holds for all the vectors for change groups on the map and, indeed, most of the change groups lie closer to their targets than to their orgins. This is a remarkable picture of how abilities operate to sort out career plans over time. Similar maps for the temperament space and the interest space are also presented in that previous report (Appendix I). Those additional maps and other analyses reveal that "ability measures were more highly related to what would happen than to what was currently planned, whereas motive measures appeared to be more related to current plans than to future plans." (p. 186)

A network of generalizations was built from a series of discriminant analyses. A general summary is as follows:

> 1. Although the ability measures increased in validity from grade 9 to the follow-up study while the motive measures decreased, the motive measures were still slightly better predictors of follow-up plans.
>
> 2. Neither ability nor motive measures were better predictors than simply asking the ninth-grade boy what he wanted to become.
>
> 3. The value of the probability prediction system was not the number of hits achieved, but the fact that it could provide information to a boy about the proportion of boys like him who would eventually be members of different types of career plan groups. (p. 204)

It should be noted that in the vocational interest scales the motives measures contained criterion information, so it is no wonder that the motive measures did slightly better than the abilities in predicting follow-up plans (42 percent hits versus 38 percent hits). Given that ninth grade interests parallel ninth grade plans, and that plans are 42 percent stable in these data, the criterion contamination effect for the motive domain is considerable. The hit rates for the trait psychology models are not depressing, because these are weak models, given the available information.

In Chapter Five we argue that a prediction scheme, marrying the career pattern record to date and the current personality trait profile as joint predictors, is the way to achieve the synthesis of the developmental and the trait-and-factor approaches Super has called for so convincingly. Meanwhile we underscore the point that the kind of prediction the youth seeking career guidance should receive from a computer measurement system is a prediction of the distribution of possible outcomes for a person with his present attributes and not a prediction that he will emerge in one specific career category.

This completes our survey of the theoretic and empiric literature on career development that provides the natural setting for the new work, based on TALENT five-years-out-of-high-school follow-up data, that we have to report. The five year follow-up data we have had the opportunity to process come from people who were in the 12th grade in 1960, and who were targets of a one-year follow-up in 1961. The third set of data on these people was collected in the fall and winter of 1965-66. We have confined the new empirical work on careers to male subjects. We subscribe to the suggestion of Roe and of Super that the career process for women needs to be conceptualized differently and researched differently than that for men. The process is probably more complex and difficult to study for women, and it is probably more urgent to acquire adequate understandings of the process for males. We do not deny that many women in our society need career guidance during the years of their education, but plainly almost all young men need it, and more urgently. If the psychology of male careers can be brought rather rapidly to the stage where it can support decent career guidance programs for males, it can do the females who ultimately marry our males no harm! Hopefully an adequate psychology of female careers will soon emerge. Meanwhile, many young women who intend to compete with their male peers for careers on the male-style can attend to the career guidance we are trying to provide as if they were males. Anyway, the Career Development Tree and related concepts and estimates which we report next in this Chapter are based on and apply to American males in our times.

After we have reported our new work, we will begin Chapter Five with a statement of what we believe to be the career development theory that the reviewed literature and the reported Project TALENT research support. Then, with the particular assistance of Tiedeman's ideas, we will describe a career guidance program for boys and young men based on that theory of careers.

The Career Development Tree

With the availability of a merged data file combining the results of the five-year follow-up questionnaire on 12th grade sample subjects, mailed in 1965, with original 12th grade data collected in 1960 and one year follow-up data collected in 1961, the authors have had an excellent opportunity to conduct trait-and-factor studies of educational and vocational transitions during a critical adjustment period of career development, the period from late adolescence to young adulthood. First, we will look at the course of career development as it is revealed in the transitions in educational and vocational plans and placements of our subjects. Then we will consider the extent and nature of the predictive validities of the abilities and motives measured in high school for criteria provided by these transition variables. Finally, we present a tree structure for career development that seems to reflect and organize all of our findings, and to provide a conceptual model for career psychology and career guidance.

The major problem in doing research on the predictability of career adjustments, be they plans or placements, is to decide upon the appropriate scaling of the criterion variable. Our primary objective being to produce information that young people need in making their many educational and vocational decisions, we have proceeded on the principle that the categories of the career criterion for any grade level should be those categories which provide the most suitable cognitive map of the world of work for dealing with the vocational adjustment tasks of that level. To be most learnable and usable, the criterion should be of minimal complexity and maximal predictability. Minimal complexity implies a one-way classification rule with as few cells as possible. Roe's two-way lattice with 48 cells is considered too complex to be learnable or usable for most youth. The multiple group discriminant functions strategy is very powerful in extracting and presenting the predictability of simple one-way taxonomies. Obtained predictabilities in this research must be accessible to the youth to be served as well as to methodologically-sophisticated scientists. It is our objective to present youths with information they can apply in their decision making, not with authoritative prescriptions they are required to take on faith.

The simplest criterion variables is a dichotomous one. In our effort to provide the simplest workable conceptual model of the career development process, we have chosen to start with a dichotomous criterion variable for the first level of development we consider, which is late elementary school. Although there has been much speculation about the possible relevance of early-childhood traits for career development, the earliest trait for which there is fairly solid research evidence is a polarization of general interests we have called the people versus thing orientation. The distinction is whether the boy's primary orientation is toward people or toward science-technology (Roe and Siegelman, 1964). This orientation first appears in student talk about vocations somewhere around fifth or sixth grade (Cooley, 1963), when the student passes from the fantasy to the interest stage in his career development. (Super, *et al.*, 1957) In interest inventories this basic orientation shows up as interest in the various science, technology, mechanical, mathematical scales versus interest in areas which involve more people contact, business, humanistic or cultural concerns. This is the earliest variable on which we find we can classify careers, and thus in our tree structure this variable defines the two branches at the first level of branching.

Project TALENT's earliest data were collected in the ninth grade, and cannot be used to examine the people-thing criterion variables at grade 5. Because the variable is important to our conceptual model, we review here (Cooley, 1963) earlier findings from the "Career Development of Scientists" study, which did include a sample of 141 fifth grade boys of above average intelligence who were followed through the ninth grade. In each of the five years involved, these boys were asked for occupational plans, and each year those choosing occupations in science or technology requiring at least a four-year college science or engineering program were classified as PSP (Potential Scientist Pool), while the others were classified NS (Non-Science). Table 4.4A shows the extent to which the fifth-grade status on this dichotomous variables predicts the status at grades six, seven, eight, and nine. There is a falling off of the percent hits with increasing time, but the stability in career plans is impressive. Granted that the PSP-NS variable is not exactly our people-thing variable since it is contaminated with level of aspiration, it seems to us to be close enough to warrant our conviction about the early emergence of a recognizable, stable primary interest orientation.

Table 4.4A: Stability of Career Plans of Fifth-Grade Boys over Five Years

		Grade 5 Plans Group		Percent Stable
		PSP	NS	
Grade 6 Classification	PSP	34	21	77%
	NS	11	75	
Grade 7 Classification	PSP	35	33	70%
	NS	10	63	
Grade 8 Classification	PSP	31	31	68%
	NS	14	65	
Grade 9 Classification	PSP	29	28	52%
	NS	16	68	

Note that by "stable" we mean that the orientation is stable enough to be worth considering. If such human personality tendencies were totally stable, neither being people nor studying people would be much fun.

On the basis of expressed occupational aspirations we have classified the TALENT ninth-grade males on the people-thing orientation. More boys are placed by their occupational aspirations on the thing side than on the people side. Table 4.5 shows that we located 7,836 boys with technological orientation and only 3,985 boys with business or sociocultural orientation in the ninth grade. Looking ahead four years to the orientation revealed by expressed occupational aspirations one year out of high school, the table shows that 48% of the boys who started with the technological orientation have retained it over four years of adolescent growth and development, while 70% of the boys who started with the people orientation retained it. Again there is enough stability to justify the position assigned the variable in our scheme, while the phenomenon of change becomes a challenging prediction problem also.

Our secondary education system forces the impingement of ability factors on career development during the junior high school years. An operational definition for branching at the second level of our model is provided by whether or not the student selects a college preparatory curriculum. By dichotomizing each of the first-level categories according to a College-Noncollege rule, we arrive at a four-category criterion variable for the second level, which covers grades seven through ten. Our names and mnemonics for the four categories are

College Science	CS
Noncollege Technology	NCT
Noncollege Nontechnology	NCNT
College Nonscience	CNS

Table 4.5 shows how the 1964 status of boys one year out of high school on this four-category variable is contingent on their 1960 ninth-grade status on the people-thing variable. We believe that the many detailed choices that are career-relevant in the period of

Table 4.5: Four-Category Breakdown of 1964 Follow-Up Plans, Contingent on Original Grade 9 (1960) Position on the People-Thing Dichotomy

1. Of 7,836 ninth-grade boys with a primary "thing" (technological) orientation, one year out of high school

23%	plan College Science careers.
25%	plan Noncollege Technology careers.
25%	plan Noncollege Nontechnology careers.
27%	plan College Nonscience careers.

[Thus, 48% have retained their thing orientation.]

2. Of 3,985 ninth-grade boys with a primary "people" (business; sociocultural) orientation, one year out of high school

10%	plan College Science careers.
20%	plan Noncollege Technology careers.
38%	plan Noncollege Nontechnology careers.
32%	plan College Nonscience careers.

[Thus, 70% have retained their people orientation.]

grades seven through ten, such as curriculum electives, extra-curricular activies, part-time jobs, as well as the major decision of choice of high school curriculum, can best be expedited and rationalized if the boy organizes his knowledge of the related worlds of school and work under the major rubrics of these four categories of careers. Project TALENT information on how these categories are predictable from ninth-grade personality profiles can help him to decide how to categorize himself in the light of his personality profile, without coercing him in any way. This kind of helping is our guidance objective.

Table 4.7 indicates considerable stability for the four-category plans criterion over four years from ninth grade to one year out. It also shows that among ninth-grade boys the most popular plans group is College Science. We know that this is an unrealistic election for most of these boys, and in fact Table 4.9 shows that by five years out of high school only 12% of boys will be pursuing College Science category objectives. Table 4.7 also shows that there is little migration of boys into College Science plans after ninth grade. The most popular migration is from College Science to College Nonscience, which might be interpreted as maintenance of high level of aspiration accompanied by a major shift in orientation of interests.

The career criterion for the third level of development in our model, which we take to be the span from grade 11 to grade 15, is an eight-category variable that is produced by again dichotomizing each of the cells of the preceding four-category criterion. The branching rule this time is a little more complex, because the two Noncollege groups are split according to a post-high-school training question, whereas the two College groups are split according to how the field orientation is refined. The College Science group is split into a Biological and Medical Sciences group and a Physical Sciences, Mathematics, and Engineering group. The College Nonscience group is split into a Business group and a Sociocultural group. Table 4.6 shows how the distribution of boys one year out of high school among these eight categories is contingent on their ninth-grade status on the People-Thing variable. Table 4.8 shows how the one-year follow-up eight category distribution is contingent on

Table 4.6: Eight-Category Breakdown of 1964 Follow-Up Plans of Ninth-Grade Boys, Contingent on 1960 People-Thing Orientation (Table Entries and Percentages of Column Sample Size)

Follow-up (1964 Career Plan	Ninth Grade (1960) Orientation Thing (N = 7836)	 People (N = 3985)
1. College, Biological-Medical Science	8%	3%
2. College, Physical Science or Engineering	16	6
3. Noncollege Technological, with Training	14	11
4. Noncollege Technological No Training	11	9
5. Noncollege Nontechnical, No Training	12	17
6. Noncollege Nontechnical, with Training	13	20
7. College, Business	9	11
8. College, Sociocultural	17	22

Table 4.7: Percentages of Stable and Changed Career Plans over Four Years for TALENT Ninth-Grade Males on Four-Category Plans Criterion

Ninth Grade Plans		Follow-up Plans (1964)				Plan N (1960)
		CS	NCT	NCNT	CNS	
CS	(College Science)	35	13	16	36	4,534
NCT	(Noncollege Technical)	12	37	33	18	3,302
NCNT	(Noncollege Nontechnical)	4	29	46	21	2,033
CNS	(College Nonscience)	16	9	28	47	1,952
						11,821

Table 4.8: Eight-Category Breakdown of 1964 Follow-Up Plans of Ninth-Grade Boys, Contingent on 1960 Status on Four-Category Plans Criterion (Table Entries are Percentages of Column Sample Sizes)

	Ninth Grade (1960) Plan			
Follow-up (1964) Career Plan	CS	NCT	NCNT	CNS
1. College, Biological-Medical Science	12	4	1	6
2. College, Physical Science or Engineering	23	8	3	10
3. Noncollege Technical, with Training	8	20	16	6
4. Noncollege, Technical, No Training	5	17	13	4
5. Noncollege Nontechnical, No Training	4	21	23	10
6. Noncollege Nontechnical, with Training	13	13	22	17
7. College, Business	12	6	8	14
8. College, Sociocultural	23	11	13	33
Sample Sizes	4534	3302	2033	1952

Table 4.9: Unconditional Percentages of Twelfth-Grade Boys in Categories of Various Career Plans Criteria for High School and Follow-Up Data

I. Two-category criterion for twelfth grade (1960) plans

1. Thing (science, technology) orientation	47%
2. People (business, sociocultural) orientation	53%
Sample Size	13,932

II. Four-category criterion for twelfth grade (1960) plans

1. College Science (CS)	24%
2. Noncollege Technical (NCT)	22%
3. Noncollege Nontechnical (NCNT)	30%
4. College Nonscience (CNS)	23%
Sample Size	13,932

III. Four-category criterion for follow-up plans

	1961 Follow-up	1965 Follow-up
1. CS	14%	12%
2. NCT	18%	24%
3. NCNT	38%	35%
4. CNS	30%	29%
Sample Size	11,988	14,799

IV. Eight-category criterion for follow-up plans

	1961 Follow-up	1965 Follow-up
1. College, Biological-Medical Science	5%	3%
2. College, Physical Science or Engineering	8%	8%
3. Noncollege Technological, with Training	10%	15%
4. Noncollege Technological, No Post-High-School Training	8%	9%
5. Noncollege Nontechnical, No Post-High-School Training	20%	17%
6. Noncollege Nontechnical, with Training	18%	19%
7. College, Business	8%	12%
8. College, Sociocultural	22%	17%
Sample Size	11,988	14,799

Table 4.9 (continued)

V. Twelve-category criterion for 1965 follow-up plans (five years out of high school), N = 14,799

1.	Ph.D. or M.D., Biological and Medical Sciences	1%
2.	D.D.S., M.S., or B.S., Biological and Medical Sciences	2%
3.	Ph.D., Physical Sciences and Mathematics	1%
4.	M.S. or B.S., Physical and Sciences and Engineering	8%
5.	Skilled and Technical Occupations with Post-High-School Training	15%
6.	Laborers, No Post-High-School Training	9%
7.	Clerks and Office Workers, No Post-High-School Training	17%
8.	Noncollege, Nontechnical, with Post-High-School Training	19%
9.	B.S. or B.A., Business	10%
10.	Graduate School, Business	1%
11.	B.S. or B.A., Sociocultural	12%
12.	Graduate School, Sociocultural	5%

the ninth grade four-category status for the same boys. These tables demonstrate that there is a substantial occurrence of erratic, path-jumping behavior, although path-following behavior dominates the tables. Path-following behavior is exhibited by individuals who branch to one of the new categories that result from splitting the categories they occupied earlier. Thus a boy who goes from College Science on the four-category variable to Biological and Medical Sciences on the eight-category variable at a later time is said to be path-following. His career plans are judged to be stable for this transition. Path-jumping behavior is exhibited by individuals who migrate over a period of time to a new category that is not a branch from a category occupied earlier. Thus a boy who goes from College Science on the four-category variable to College Business on the eight-category variable at a later time is said to be path-jumping, and his career plans are judged to be unstable for this transition. "Branching" is "path-following" and is "stable." "Migrating" is "path-jumping" and is "unstable." We have seen that one of the postulates of career theory is that decisions tend to be irreversible, so that path-jumping may be difficult, costly, wasteful, and perhaps anxiety-producing. Nevertheless, the TALENT data reveal a lot of path-jumping. Table 4.10 tabulates the one-year transitions in plans between senior year in high school and one year out, from the four-category variable to the eight-category variable. The two percentages in each of the four columns that are underlined represent the path-following transitions for that column. The other six percentages are path-jumping transitions. Over this one year period in late adolescence stable career transitions predominate. Yet there are some striking percentages of path-jumping transitions, especially the 26% who move from College Science to College Sociocultural in one year, and the 28% who move from Noncollege Technical to Noncollege Nontechnical with No Training.

The final career criterion variable of our model, for the fourth level beginning at Grade 16 (Senior year in college), is created by dichotomizing the four college cells of the eight-category variable according to whether advanced graduate study is planned. Part V

Table 4.10: Eight-Category Breakdown of 1961 Follow-Up Plans of Twelfth-Grade Boys, Contingent on Four-Cateogry 1960 Plans Status (Table Entries Are Percentages of Column Sample Sizes)

	Twelfth Grade (1960) Plans			
One Year Follow-up (1961) Career Plans	CS	NCT	NCNT	CNS
1. College, Biological-Medical Science	14	1	<1	3
2. College, Physical Science or Engineering	24	4	<1	3
3. Noncollege Technical, With Training	9	20	11	2
4. Noncollege Technical, No Training	2	26	8	1
5. Noncollege Nontechnical, No Training	9	28	36	10
6. Noncollege Nontechnical, With Training	8	14	32	18
7. College, Business	8	1	4	18
8. College, Sociocultural	26	6	8	45
Sample Sizes	3,733	1,979	2,257	3,377

of Table 4.9 lists the 12 categories that result, and reports the percentage distribution of 14,799 males five years out of high school on the variable. The young men are well dispersed among the categories, with the highest level-of-training categories having the smallest memberships. Table 4.11 shows how the five-year follow-up distribution on this twelve-category variable is contingent upon the 12th-grade distribution on the four-category variable. Table 4.12 reports the contingency distribution of the twelve-category five-year follow-up data on the eight-category one-year follow-up data. In both tables, underlined entries are percentages of stable career plans. Viewed together, the two tables reveal that plans stabilize considerably _after_ high school graduation. The interpretation might be that the first year out of high school graduation. The interpretation might be that the first year out of high school is a time of significant reality-testing and development of commitment. To summarize then, our career criteria start with a dichotomous orientation variable suitable for grades 4-6, move to a four-category variable for grades 7-10, then to an eight-category variable for grades 11-15, and finally to a twelve-category taxonomy of occupations for grades 16 on. A new level of complexity is achieved by dichotomizing all or some of the cells of the previous level. Except for the initial dichotomy, all of the criterion variables involve both field and level considerations, but the variable is always a one-way categorical variable. The use of dichotomies throughout provides the path-following subject with a simple choice between two alternatives at each stage of development. We have shown that there are many such path-following boys, whose career patterns we describe as stable. Boys whose decisions create discontinuities in their career patterns become path-jumpers in this model. Putting all the variables in sequence forms a logical tree structure. Each path through the tree structure is a career pattern. Constantly forward paths are stable patterns, whereas paths requiring any retracing, or jumping, are unstable patterns. The structure extends over time, and we have shown that locations at given times ahead _and_ transitions are predictable from personality attributes measured in adolescence. Figure 4.1A is this Career Development Tree. It is the theoretical model of careers which is currently

Project TALENT
Career Development Tree

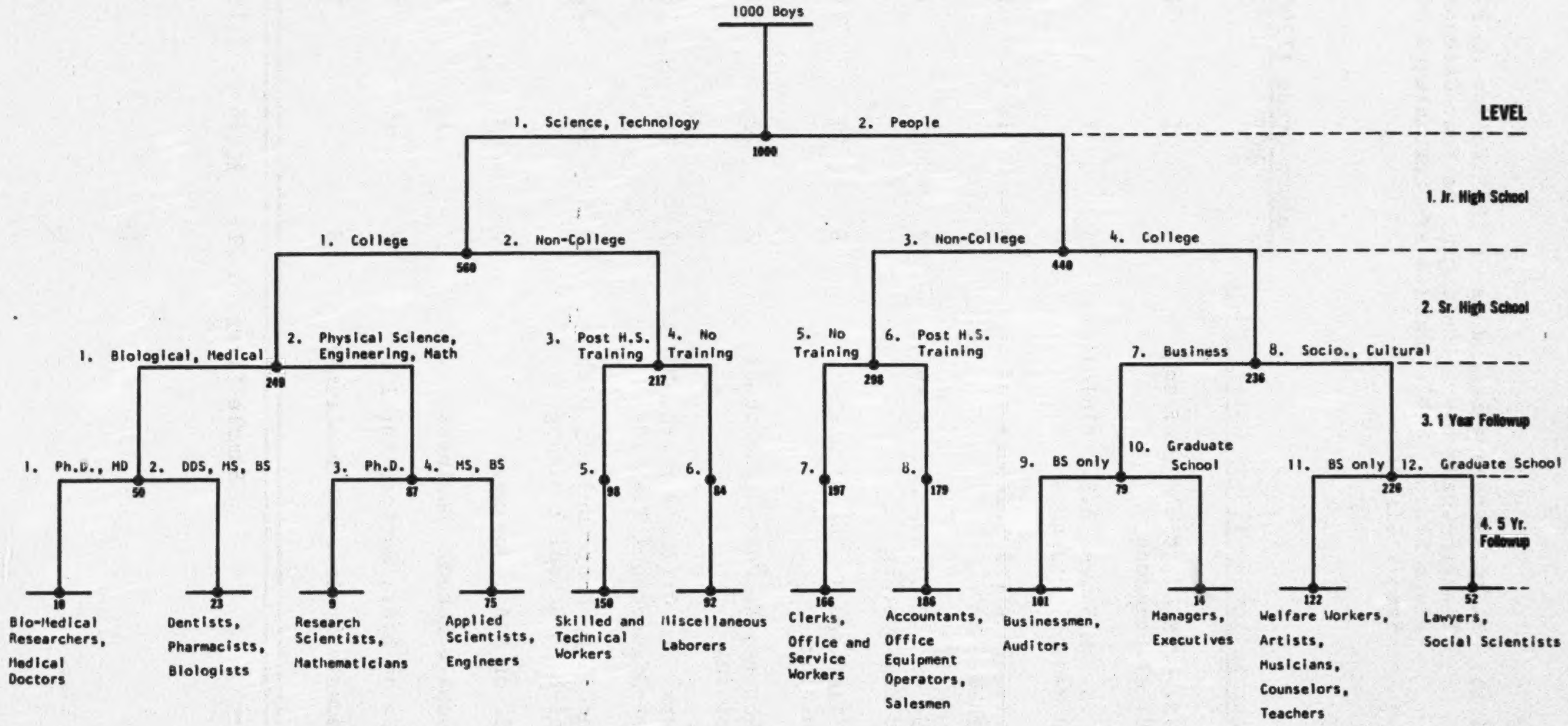

1000 Boys
1. Science, Technology
2. People
1000
LEVEL
1. Jr. High School
1. College
2. Non-College
560
3. Non-College
4. College
440
2. Sr. High School
1. Biological, Medical
2. Physical Science, Engineering, Math
240
3. Post H.S. Training
4. No Training
217
5. No Training
6. Post H.S. Training
298
7. Business
8. Socio., Cultural
236
3. 1 Year Followup
1. Ph.D., MD
2. DDS, MS, BS
50
3. Ph.D.
4. MS, BS
87
5.
98
6.
84
7.
197
8.
179
9. BS only
10. Graduate School
79
11. BS only
12. Graduate School
226
4. 5 Yr. Followup
10
Bio-Medical Researchers, Medical Doctors
23
Dentists, Pharmacists, Biologists
9
Research Scientists, Mathematicians
75
Applied Scientists, Engineers
150
Skilled and Technical Workers
92
Miscellaneous Laborers
166
Clerks, Office and Service Workers
186
Accountants, Office Equipment Operators, Salesmen
101
Businessmen, Auditors
14
Managers, Executives
122
Welfare Workers, Artists, Musicians, Counselors, Teachers
52
Lawyers, Social Scientists

Figure 4.1A

Table 4.11: Twelve-Category Breakdown of 1965 Follow-Up Plans of Twelfth-Grade Boys, Contingent on Four-Category 1960 Plans Status (Table Entries Are Percentages of Column Sample Sizes)

	Twelfth Grade (1960) Plan			
Five-Year Follow-up (1965) Career Plan	CS	NCT	NCNT	CNS
1. Ph.D. or M.D., Biological and Medical Sciences	3	1	1	1
2. D.D.S., M.S., or B.S., Biological and Medical Sciences	6	1	1	2
3. Ph.D., Physical Sciences and Mathematics	3	1	1	1
4. M.S. or B.S., Physical Sciences and Engineering	19	5	2	5
5. Skilled and Technical with Training	8	29	18	5
6. Laborers, No Post-High-School Training	2	22	11	2
7. Clerks and Office Workers, No Post-High-School Training	7	19	28	10
8. Noncollege Nontechnical, with Post-High-School Training	10	16	27	19
9. B.S. or B.A., Business	15	3	6	18
10. Graduate School, Business	2	1	1	2
11. B.S. or B.A., Sociocultural	17	4	7	23
12. Graduate School, Sociocultural	8	1	1	13
Sample Sizes	4,217	2,646	3,113	3,955

Table 4.12: Twelve-Category Breakdown on 1965 Follow-Up Plans of Twelfth-Grade Boys, Contingent on Eight-Category 1961 Follow-Up Career Plans Status (Table Entries are Percentages of Row Sample Sizes)

1961 Plans Groups	1965 Plans Groups												1961 Sample Sizes
	1	2	3	4	5	6	7	8	9	10	11	12	
I	20	19	2	8	1	0	7	2	8	1	17	15	728
II	1	3	6	40	5	0	4	7	12	3	11	7	1,451
III	0	4	0	14	42	4	9	17	5	0	5	1	1,258
IV	0	1	0	3	27	27	18	16	1	2	5	0	836
V	0	2	0	2	16	18	31	21	40	0	5	1	1,699
VI	0	1	0	7	18	1	6	34	14	2	15	2	1,964
VII	0	1	0	11	3	0	6	11	45	4	15	4	1,028
VIII	1	4	3	8	7	0	3	5	14	2	32	21	3,024

guiding our career pattern research.

Our 12th-grade males have now provided occupational aspirations data three times, in 1960, 1961, and 1965. We thus can trace these subjects through two career plan transitions: 1) from the four-category 1960 variable to the eight-category 1961 variable (Table 4.10); and 2) from the eight-category 1961 variable to the twelve-category 1965 variable (Table 4.12). There are 4 x 8 x 12 = 384 paths through these transitions. Only twelve of these many paths represent direct branching routes, or stable careers. All the others require path-jumping at least once. The entries for the twelve stable paths are underlined in Table 4.13, which gives percentages following all 384 paths. The proportion of stable careers is impressive. No entry is given when a path was used by less than one-half of one percent of the subjects who arrived in a given one of the twelve final cells. There are 113 such seldom-traveled paths. Perhaps the most important lesson of Table 4.13 is the support it implies for criterion variables with small numbers of categories in longitudinal studies of careers. The authors have tried to be as parsimonious as possible in defining their criteria, yet here in two transitions they are confronted with 384 possible behaviors. If we are going to have useful probability models for studies incorporating several or many transitions, we will have to employ criterion variables with very small numbers of categories.

Because of the complexity of Table 4.13, certain of its most interesting results have been abstracted in Tables 4.14, 4.15, 4.16, and 4.17. These tables present results in full sentences much as they might be presented to students by a career guidance information system. We hope it is evident that beginning in grade 11 students need the eight-category map of the world of education and work to help them plan for post-high-school activities, and that beginning in grade 16 (senior year in college), students need the further detail of the twelve-category scheme, particularly if they are going to graduate from a four year college program. We think that by age 22 most young men who are not college students can use and benefit

Table 4.13: Percentages of Males Arriving in Each of 12 Career Categories on the Five-Year Follow-Up from Various Paths.

Source Path		Five-Year Follow-up Plan (1965)*												N
Twelfth Grade Plan (1960)	One-Year Follow-up Plan (1961)	1	2	3	4	5	6	7	8	9	10	11	12	
College Science	Biological-medical	23	18	2	9	1		9	1	8	1	14	15	565
	Phys. Sci., Eng.	1	2	7	45	3		5	3	12	3	13	8	1144
	NCT and Training		9		23	31	1	1	16	12	1	5	2	352
	NCT, No Training	3	5	2	13	12	6	7	5	5		40	2	100
	NCNT, No Training		11		7	20	5	14	22	10		7	5	143
	NCNT and Training		1		8	15		4	28	20	5	16	2	269
	Business (C)		1		17	7		6	6	44	3	14	2	262
	Sociocultural (C)	3	6	9	14	5		2	3	14	2	29	14	898
Noncollege Technology	Biological-medical	2	17		4	6	2		5	3	2	58	2	34
	Phys. Sci., Eng.	2	3		32	22	2		13	15	1	7	3	118
	NCT and Training		1		17	47	4	11	15	2		3		455
	NCT, No Training				4	33	36	18	9			1		425
	NCNT, No Training				1	21	37	19	17	1		4		465
	NCNT and Training		2		6	28	3	9	38	9		6		326
	Business (C)				9	8	6		14	43	5	12	3	38
	Sociocultural (C)	1	1	1	17	27		1	11	8	14	16	4	118
Noncollege Nontechnology	Biological-medical		40							15		45		9
	Phys. Sci., Eng.		5		11	43	8		8	16		8		23
	NCT and Training				3	52	7	14	15	2		7		262
	NCT, No Training					23	21	31	23	1		1		224
	NCNT, No Training					11	14	45	24	2		3		740
	NCNT and Training				6	23	1	5	36	12		16		691
	Business (C)				4	2	1	1	25	47	2	17	1	112
	Sociocultural (C)		1		10	7			8	18	2	47	8	196
College Nonscience	Biological-medical	11	17	3	3	2			2	11	1	25	26	94
	Phys. Sci., Eng.	3	14	3	13	3	1		39	12	3	7	4	113
	NCT and Training		7	1	11	33		15	16	9		7	1	119
	NCT, No Training				7	14	7	14	24	4		28	3	34
	NCNT, No Training				6	13	15	16	23	12	1	12	2	233
	NCNT and Training		1		6	7		6	32	19	4	19	6	548
	Business (C)	1			10	1		8	10	44	4	16	6	570
	Sociocultural (C)	1	3	1	3	5		5	5	14	2	34	28	1666

*The twelve five-year follow-up career categories

1. Ph.D. or M.D. bio-med.
2. D.D.S., M.S., or B.S. bio-med.
3. Ph.D. phys. science or math
4. M.S. or B.S. phys. science or eng.
5. Skilled or technical with post-high-school training
6. Laborers
7. Untrained clerks and office workers
8. Noncollege, nontechnical with post-high-school training
9. College, business
10. Graduate school, business
11. B.S. sociocultural
12. Graduate school, sociocultural

Table 4.14: Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as High School Seniors and Planned College Biological-Medical Science Programs One Year Later. (N = 565)

23% are pursuing bio-med Ph.D. or M.D. programs.

18% have settled for bio-med D.D.S., M.S., or B.S. degrees.

2% are pursuing physical science Ph.D. programs.

9% have settled for physical science or engineering M.S. or B.S. degrees.

[Thus, 52% have established science-type careers.]

11% are in noncollege occupations.

9% are in postcollege business pursuits.

28% are in postcollege sociocultural pursuits.

[Thus, 89% have graduated from college.]

Table 4.15: Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as Seniors and Planned College Physical Science Programs One Year Later. (N = 1144)

3% are pursuing bio-medical science careers.

7% are pursuing physical science Ph.D. programs.

45% have settled for physical science or engineering M.S. or B.S. degrees.

[Thus, 55% have established science-type careers.]

11% are in noncollege occupations.

15% are in postcollege business pursuits.

20% are in postcollege sociocultural pursuits.

[Thus, 90% have graduated from college.]

Table 4.16: Five Year Follow-Up Outcomes for Boys Who Planned College Science Programs as Seniors and Planned Noncollege Technical Training Programs One Year Later. (N = 352)

1%	are pursuing Ph.D. or M.D. science degrees.
9%	have settled for bio-med D.D.S., M.S., or B.S. degrees.
23%	have settled for physical science or engineering M.S. or B.S. degrees.
[Thus, 33%	have established science-type careers.]
30%	are trained skilled and technical workers.
18%	are in noncollege, nontechnical occupations.
19%	are in postcollege, nontechnical positions.
[Thus, 52%	have graduated from college.]

Table 4.17: Five-Year Follow-Up Outcomes for Boys Who Planned College Science Programs as Seniors and Planned College Sociocultural Programs One Year Later. (N=898)

11%	are pursuing Ph.D. or M.D. science degrees.
6%	have settled for bio-med D.D.S., M.S., or B.S. degrees.
14%	have settled for physical science or engineering M.S. or B.S. degrees.
[Thus, 31%	have established science-type careers.]
10%	are in noncollege occupations.
15%	are in postcollege business pursuits.
29%	have settled for B.S. degree sociocultural pursuits.
14%	are pursuing graduate sociocultural programs.
[Thus, 89%	have graduated from college.]

from the more-detailed view of the structure of occupations in our society given by the twelve-category criterion, even if the additional categories are not personally relevant for them.

How predictable are these career criterion variables from the high school personality factor profiles of the subjects? On what combinations of factors are career plans and changes in plans over time most dependent? Given the stated purposes of Project TALENT, these are perhaps the most crucial questions of predictive validity for the TALENT measurement battery. The overriding ambition of Project TALENT has been to help young people to understand how they might deploy their abilities and motives to good advantage in planning their career development. From the many different computational schemes we could have pursued in researching these questions, we have selected three analyses to report in detail, because we think they illuminate the questions of "how much" and "how obtained" regarding MAP factor predictive validities very nicely. First, we report a multiple group discriminant analysis for the concurrent validity of the 12th-grade MAP profiles for the criterion provided by the twelve-category classification of 12th-grade occupational aspirations. We have asserted that 12th-grade plans do not require a more detailed classification than that provided by the eight-category criterion variable, but we have done this analysis with twelve groups to make it completely comparable with the second analysis we report. The second analysis reported is of the predictive validity of the 12th-grade MAP profiles for the twelve-category plans criterion based on five-year follow-up plans. The results indicate strong concurrent and five-year predictive validities, with good agreement in the factor combinations from which predictability obtains in the two analyses. The third analysis reported is a discriminant analysis in the MAP factors space for 41 change groups representing transitions in plans from the four-category variable in 12th-grade to the twelve-category variable five years out of high school. This analysis allows us to map 12 stable plan groups in the best plane in the personality space, and to chart the tendency of unstable plan groups to move toward suitable targets for their members.

For the concurrent validity study, the two best predictors of the twelve groups are Scholasticism in the Motives domain and Mathematics in the Abilities domain. The third best predictor is Science Interests in the Motives domain, while the fourth best predictor is Verbal Knowledges in the Abilities domain. Thus both domains of personality contribute importantly to the predict - ability of plans. Table 4.18 gives the centroid (profile of means) for each of the twelve plan groups on the nine most useful predictors. Notice that all four interest factors are among the nine best predictors, but it is the pattern of interest scores that is important for each group, not any one interest by itself. Indeed, the table illustrates that groups are differentiated by unique centroids or profiles in the measurement space, not by key variables. The multiple regression coefficients (Mult R) reported are correlations between optimally-weighted linear combinations of dummy variates for group membership and the individual factors as criterion variables. Each multiple regression coefficient represents the extent of regression of a factor on the vector variable of group membership codes. A subject's dummy variate scores are zero for all groups except a one for the group in which his occupational aspiration is classified. We see that two factors, Scholasticism and Mathematics, have impressive univariate predictive validities for the twelve-category career plans criterion as measured concurrently.

That the multivariate predictive validity is considerably stronger is revealed by Table 4.19, which reports a canonical correlation of .71 between the first discriminant function and an optimally-weighted combination of the membership variates. The table also gives the correlations of all 22 MAP factors with the three best discriminant functions, and the interpretive names that have been assigned to the functions in the light of these loadings. Notice that the first and second functions depend on both personality domains working together to partially determine career plans. These

Table 4.18: Group Means on Best MAP Predictors (with Multiple Regression Coefficients for Factors) for 1960 Twelfth-Grade Career Plans

				RANK:	4	2	9	8	1	5	6	3	7
		Career Plans Group	N	FACTOR:	VKN	MAT	VIS	BUS	SCH	OUT	CUL	SCI	SOC
				Mult R:	.43	.57	.22	.26	.58	.35	.31	.50	.28
1	(MED)	Ph.D. or M.D., Biological and Medical Sciences	448		60	75	56	43	60	57	42	75	48
2	(BIO)	D.D.S., M.S., B.S., Biological and Medical Sciences	458		57	68	56	46	57	60	38	71	52
3	(RES)	Ph.D., Physical Sciences and Mathematics	947		59	80	61	45	61	60	38	71	45
4	(ENG)	M.S. or B.S., Physical Sciences and Engineering	1,271		55	71	61	47	56	64	35	68	49
5	(TEC)	Skilled and Technical, with Training	866		50	59	59	47	49	68	35	61	50
6	(LBR)	Laborers, No Post-High-School Training	953		47	57	60	46	47	69	36	58	49
7	(CLK)	Clerks and Office Workers, No Post-High-School Training	1,094		50	54	57	48	47	65	39	57	52
8	(ACT)	Noncollege Nontechnical, with Training	904		53	55	56	51	49	62	37	59	53
9	(BUS)	B.S. or B.A., Business	716		57	63	55	53	54	59	36	63	55
10	(MGT)	Graduate School, Business	157		58	70	55	54	57	57	39	65	53
11	(WEL)	B.S. or B.A., Sociocultural	723		56	61	55	48	53	60	42	62	54
12	(PRF)	Graduate School, Sociocultural	785		61	67	55	48	57	57	46	63	50

Table 4.19: Factor-Discriminant Correlations and Canonical Correlations for Twelfth-Grade Career Plans in Concurrent MAP Space

	Discriminant Functions		
	I	II	III
Canonical Correlation	.71	.48	.31
MAP Factors			
Abilities			
Verbal Knowledges	.55	.33	.00
Perceptual Speed, Accuracy	.12	.08	-.21
Mathematics	.75	-.34	-.12
Hunting-Fishing	.01	-.20	-.12
English	.18	.22	.04
Visual Reasoning	.03	-.44	-.07
Color, Foods	.08	.03	.19
Etiquette	.09	.09	-.14
Memory	.01	.03	.01
Screening	-.23	-.30	-.13
Games	.11	-.07	-.20
Motives			
Business interests	-.12	.38	-.51
Conformity Needs	.28	.15	-.11
Scholasticism	.81	-.01	-.07
Outdoors, Shop Interest	-.36	-.49	-.01
Cultural Interests	.15	.41	.67
Activity Level	-.09	-.19	.05
Impulsion	.02	.13	.04
Science Interests	.64	-.31	-.17
Sociability	-.20	.43	-.26
Leadership	.21	.24	.17
Introspection	.01	-.08	.19

DF I: Science-oriented Scholasticism

DF II: Technical versus Sociocultural

DF III: Business versus Cultural

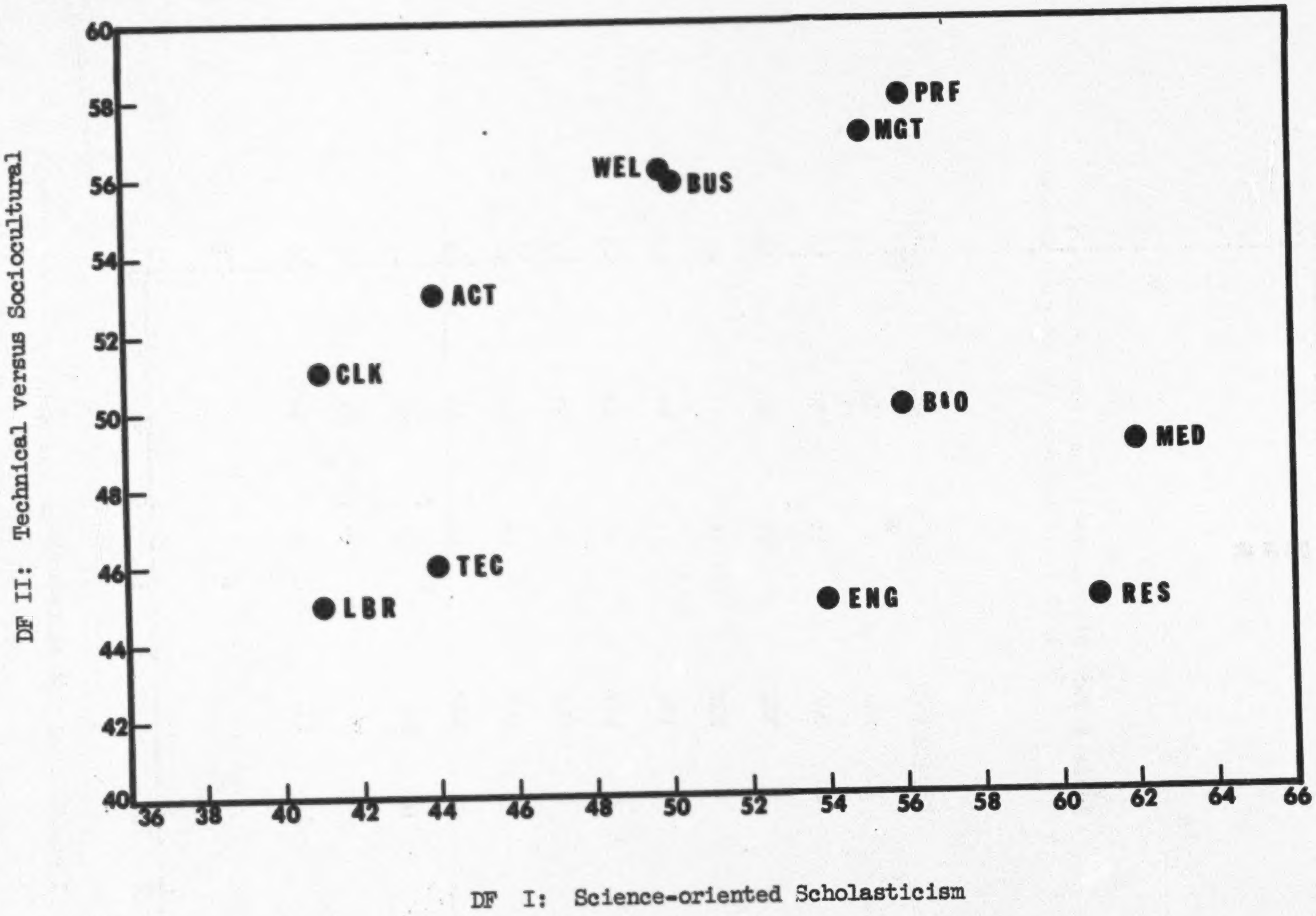
functions show how abilities and motives interact to influence vocational decisions. They are major heuristic outcomes of our research. The centroids of the twelve groups on the three discriminant functions are reported in Table 4.20. The highest educational aspiration groups are at one end of DF I and the lowest educational aspiration groups are at the other end. The science-technology oriented groups are at one end of DF II and the entrepreneurial-humanistic oriented groups are at the other end. DF III splits the entrepreneurial from the humanistic. The first and second discriminant functions define a plane in the MAP measurement space, and the groups can be plotted on this plane according to their means on the two functions. Figure 4.2 does just this. We believe that this figure can give a high school boy the best available view of how the vocational aspirations of 12th-grade males map into a personality measurement space. A computer measurement system in support of a career guidance program could process his measurement profile and plot a point for him on this map. It would seem that this information would help the student to assess his own aspirations.

The multiple group discriminant analysis of the five-year follow-up career plans of the 12th-grade sample is reported in Tables 4.21, 4.22, 4.23 and Figure 4.3. These should be compared with Tables 4.18, 4.19, 4.20 and Figure 4.2. The similarities in detail of the findings of the two studies are remarkable. The three best discriminants of the five-year follow-up study are clearly practically the same as what they were in the concurrent criterion study. The groups have moved very little in the measurement space as a result of five crucial years of reality testing, and the movement that has occurred has been in directions one would have expected. That is, the trends of Figure 4.2 are simply sharpened in Figure 4.3.

Further evidence of the stability of the heuristic model for a psychometric taxonomy of career plans is provided by the outcomes of a discriminant analysis of 41 plans change groups in the MAP factors space. To define change groups, the four-category criterion

Table 4.20: Discriminant Function Centroids for 1960 Twelfth-Grade Career Plan Groups

Plan Group		DF I	DF II	DF III
1	MED	62	49	54
2	BIO	56	50	50
3	RES	61	45	50
4	ENG	54	45	47
5	TEC	44	46	49
6	LBR	41	45	53
7	CLK	41	51	52
8	ACT	44	53	47
9	BUS	50	56	44
10	MGT	55	57	46
11	WEL	50	56	52
12	PRF	56	58	55



Figre 4.2: Centroids of 12th-Grade Career Plan Groups in Discriminant Plane.

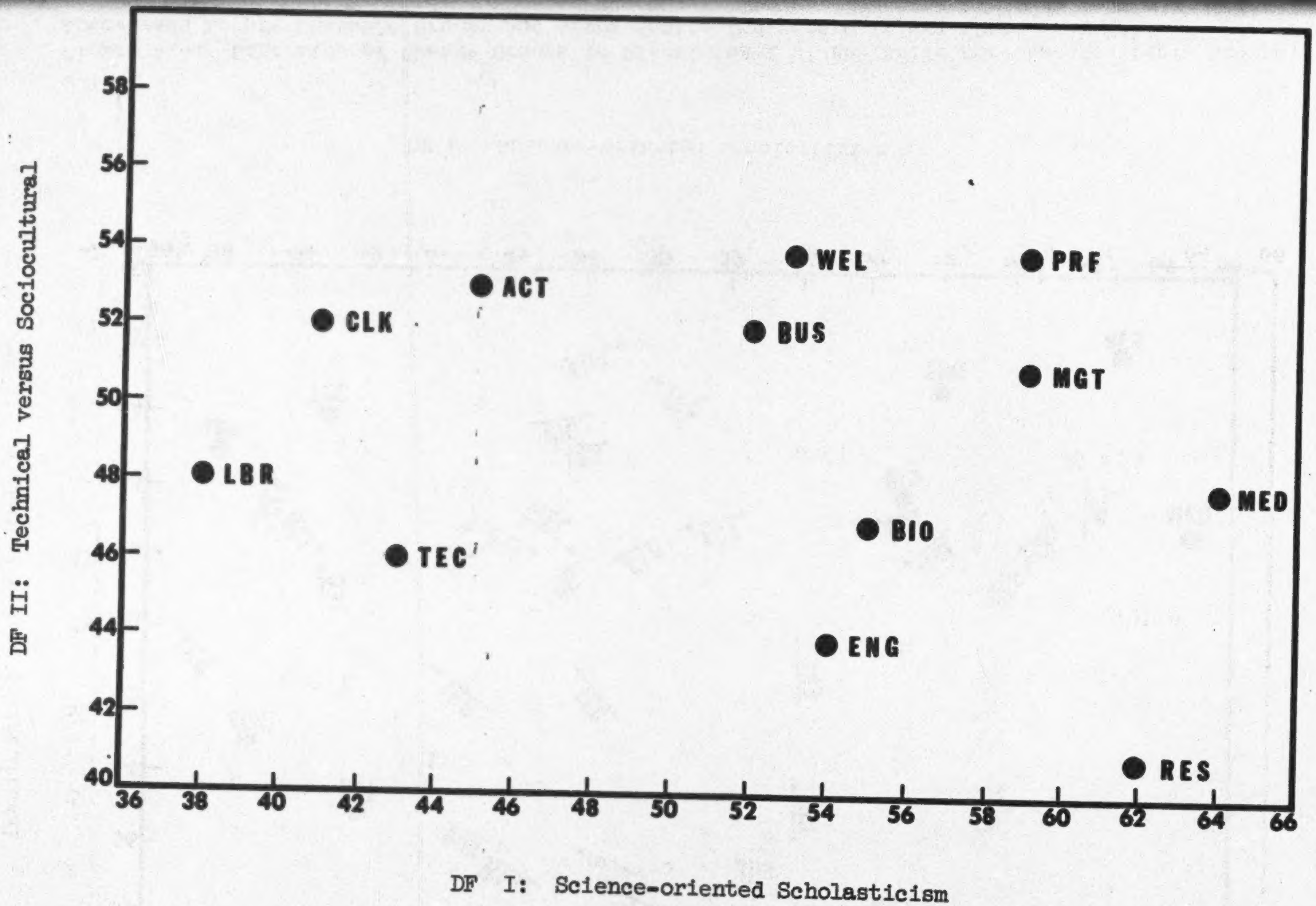


Figure 4.3: Centroids of Five-Year Follow-Up Career Plan Groups in Discriminant Plane.

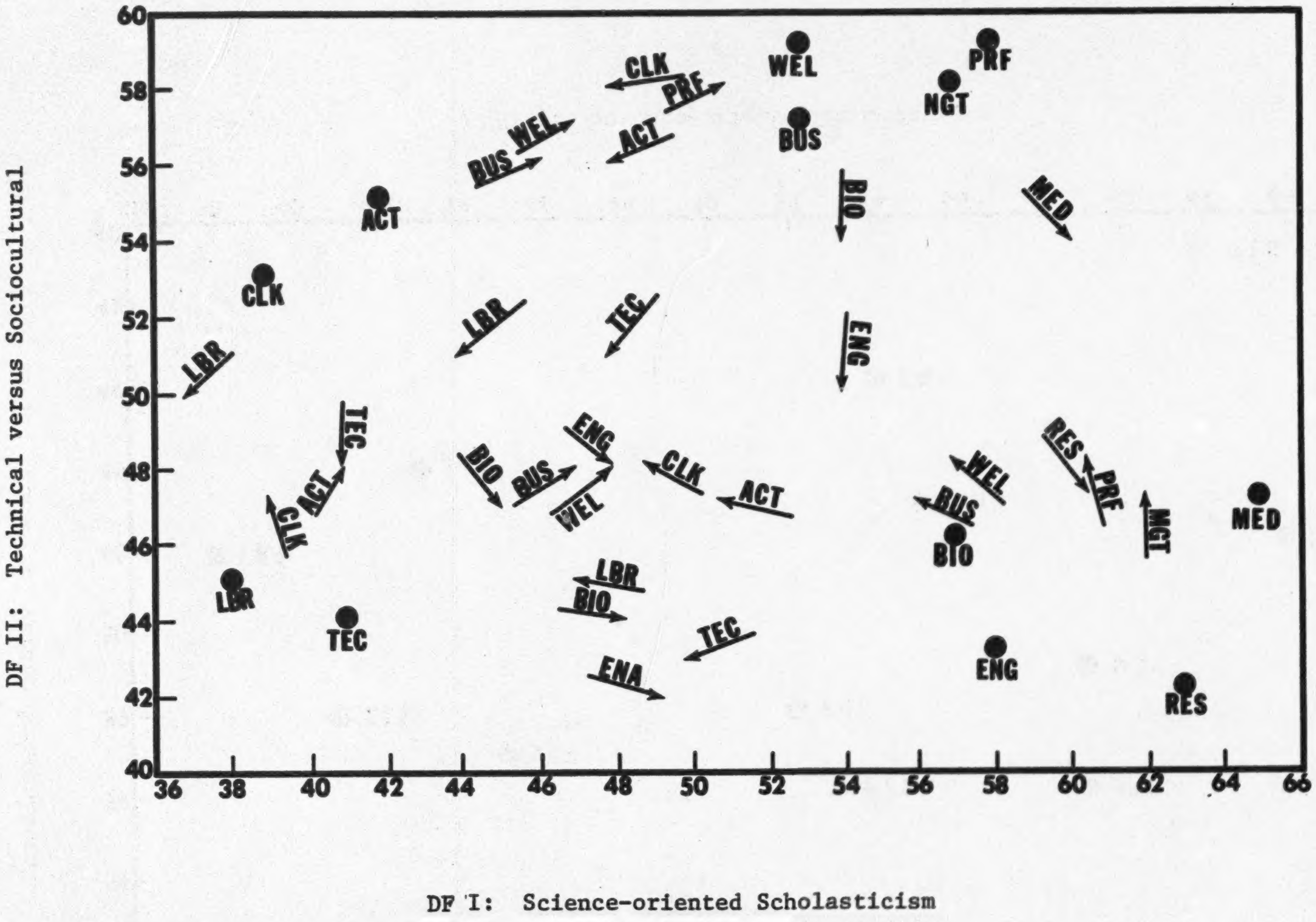


Figure 4.4: Centroids of Change Groups in Discriminant Plane (Solid Dots Locate Stable Groups; Arrowheads Locate Unstable Groups and Arrow Shafts Indicate Origins) (Data from Table 4.26)

Table 4.21: Group Means on Best MAP Predictors (with Multiple Regression Coefficients for Factors) for 1965 Five-Year Follow-Up Career Plans

Career Plans Group		N	RANK:	3	2	8	9	1	5	6	4	7
			FACTOR:	VKN	MAT	VIS	BUS	SCH	OUT	CUL	SCI	SOC
			Mult R:	.44	.54	.18	.18	.54	.33	.29	.41	.25
1	MED	279		61	80	56	44	62	57	42	73	45
2	BIO	438		57	69	59	45	56	62	38	70	50
3	RES	221		61	84	60	45	63	60	38	72	42
4	ENG	939		56	74	61	47	57	64	35	69	48
5	TEC	1,297		50	59	60	46	49	67	35	61	50
6	LBR	706		46	54	57	47	46	69	34	56	50
7	CLK	530		49	53	55	49	48	64	37	58	52
8	ACT	1,430		53	57	57	49	49	63	38	60	54
9	BUS	1,214		56	65	56	50	54	61	36	65	53
10	MGT	270		60	75	57	52	59	57	36	68	50
11	WEL	1,183		57	64	57	48	54	60	43	64	51
12	PRF	815		61	72	55	47	59	57	44	66	49

Table 4.22: Factor-Discriminant Correlations and Canonical Correlations for Five-Year Follow-Up Career Plans in Twelfth-Grade MAP Space

	Discriminant Functions		
	I	II	III
Canonical Correlation	.69	.37	.23
MAP Factors			
Abilities			
Verbal Knowledges	.62	.20	-.07
Perceptual Speed, Accuracy	.02	.10	-.17
Mathematics	.73	-.49	-.07
Hunting-Fishing	-.10	-.26	-.03
English	.28	.23	.06
Visual Reasoning	-.01	-.43	-.07
Color, Foods	.08	.10	.15
Etiquette	.05	.07	-.10
Memory	.00	.01	.05
Screening	-.33	-.25	.05
Games	.10	-.05	-.29
Motives			
Business Interests	-.04	.31	-.51
Conformity Needs	.21	.12	-.08
Scholasticism	.78	-.19	-.06
Outdoors, Shop Interests	-.41	-.42	.07
Cultural Interests	.25	.47	.61
Activity Level	-.22	-.10	-.10
Impulsion	-.01	.08	-.06
Science Interests	.54	-.36	-.23
Sociability	-.19	.47	-.43
Leadership	.28	.22	.04
Introspection	-.06	-.03	.18

DF I: Science-oriented Scholasticism

DF II: Technical versus Sociocultural

DF III: Business versus Cultural

Table 4.23: Discriminant Function Centroids for 1965 Five-Year Follow-Up Career Plan Groups.

Plan Group		DF I	DF II	DF III
1	MED	64	48	54
2	BIO	55	47	50
3	RES	62	41	52
4	ENG	54	44	48
5	TEC	43	46	51
6	LBR	38	48	53
7	CLK	41	52	50
8	ACT	45	53	49
9	BUS	52	52	46
10	MGT	59	51	45
11	WEL	53	54	52
12	PRF	59	54	53

for 1960 12th-grade plans was considered in conjunction with the twelve-category criterion for 1965 five-year follow-up plans. Of the 48 possible transitions, 41 were found to contain sufficient subjects for inclusion in the study. Table 4.24 defines the 41 groups, gives their sample sizes, indicates the 12 groups that represent stable career plans over the five-year period (or path-following careers) and the 29 unstable or path-jumping groups, and reports the centroid for each group on the six most useful predictors. These are the same factors that were the best predictors in the two studies just reported, and notice how similar the multiple regression coefficients for the factors are to those obtained previously. The canonical correlations of Table 4.25 are close to those obtained previously also, and the pattern of factor-discriminant correlations makes it clear that again we have obtained practically the same three best discriminant functions. Table 4.26 gives the discriminant function centroids for the 41 groups. In Figure 4.4 the twelve groups representing stable career plans are plotted as solid dots. Notice that these groups, representing only those subjects who arrived in each of the twelve cells of the psychometric taxonomy without path-jumping from 1960-1965, are mapped just about as they are in Figure 4.3, which uses all subjects who arrived at each of the cells. Each arrowpoint in Figure 4.4 locates the centroid of an unstable, or path-jumping, transition group, and the arrowshaft runs back toward the approximate center of gravity of the cluster of stable groups representing the four-cateogry criterion 1960 origin of the transition group. The four clusters are indicated by the four colors used for solid dots and arrows. Thus the color of an arrow reveals its four-category origin, while the code name on it reveals its twelve-category destination. For example, the red arrow with the code "BIO" locates transition group 31, CNS-BIO of Table 4.26. This group consists of 76 boys who were classified as College Nonscience in 1960 and as Ph.D. or M.D., Biological and Medical Sciences in 1965. They have path-jumped from a nonscience to a science orientation.

Table 4.24: Change Group (1960-1965) Means on Best MAP Predictors (with Multiple Regression Coefficients for Factors) (+ Indicates Stable Group)

	Career Plans Change Group	N	Rank	4	1	2	5	6	3
			Factor	VKN	MAT	SCH	OUT	CUL	SCI
			Mult R	.48	.63	.62	.39	.33	.53
1	CS - MED+	229		61	81	63	57	41	75
2	CS - BIO+	300		57	72	58	61	38	73
3	CS - RES+	189		61	85	63	61	38	72
4	CS - ENG+	529		57	78	60	63	34	71
5	CS - TEC	292		53	67	53	65	34	67
6	CS - LBR	44		50	62	51	64	35	65
7	CS - CLK	32		54	61	52	63	35	68
8	CS - ACT	226		54	65	53	63	36	68
9	CS - BUS	432		57	72	57	62	35	70
10	CS - MGT	121		60	80	62	59	35	72
11	CS - WEL	396		58	71	57	61	40	69
12	CS - PRF	334		60	77	60	58	41	71
13	NCT - BIO	37		55	63	51	67	38	65
14	NCT - ENG	174		53	69	52	66	35	66
15	NCT - TEC+	442		47	57	47	69	34	59
16	NCT - LBR+	371		44	55	45	71	33	56
17	NCT - CLK	153		47	53	47	69	34	57
18	NCT - ACT	358		50	55	47	67	36	58
19	NCT - BUS	130		51	62	51	64	36	64
20	NCT - WEL	117		53	62	51	66	42	64
21	NCNT - BIO	25		53	59	49	68	37	64
22	NCNT - ENG	70		56	62	50	64	38	64
23	NCNT - TEC	394		50	55	47	67	35	58
24	NCNT - LBR	259		47	52	44	68	35	55
25	NCNT - CLK+	275		47	52	46	63	37	56
26	NCNT - ACT+	444		51	52	47	62	38	57
27	NCNT - BUS	238		54	57	50	61	36	60
28	NCNT - WEL	232		55	56	50	60	45	60
29	NCNT - PRF	44		57	62	54	58	49	59
30	CNS - MED	41		62	74	59	59	45	66
31	CNS - BIO	76		58	64	55	60	40	66
32	CNS - RES	29		61	79	61	60	42	71
33	CNS - ENG	166		57	69	56	62	38	67
34	CNS - TEC	169		53	60	53	63	37	64
35	CNS - LBR	32		50	55	49	64	36	61
36	CNS - CLK	70		55	58	52	59	41	61
37	CNS - ACT	402		55	58	52	60	41	61
38	CNS - BUS+	414		58	64	55	58	38	63
39	CNS - MGT+	129		60	71	58	56	38	64
40	CNS - WEL+	438		59	62	54	58	44	60
41	CNS - PRF+	415		62	69	58	56	46	62

Table 4.25: Factor-Discriminant Correlations and Canonical Correlations for 1960-1964 Career Plans Change Groups in Twelfth-Grade MAP Space

	Discriminant Functions		
	I	II	III
Canonical Correlations	.77	.54	.26
MAP Factors			
Abilities			
Verbal Knowledges	.59	.28	.01
Perceptual Speed, Accuracy	.07	.06	-.28
Mathematics	.76	-.38	.01
Hunting-Fishing	-.04	-.25	-.12
English Language	.24	.24	.13
Visual Reasoning	.01	-.42	-.04
Color, Foods	.06	.05	.13
Etiquette	.07	.07	-.11
Memory	.01	.03	.02
Screening	-.28	-.30	-.00
Games	.10	-.07	-.27
Motives			
Business Interests	-.07	.38	-.44
Conformity Needs	.24	.10	-.17
Scholasticism	.81	-.07	-.03
Outdoors, Shop Interest	-.37	-.46	.08
Cultural Interests	.17	.44	.61
Activity Level	-.17	-.20	-.16
Impulsion	.00	.09	-.08
Science Interests	.61	-.38	-.31
Sociability	-.18	.42	-.47
Leadership	.26	.25	.11
Introspection	-.04	-.06	.16

DF I: Science-oriented Scholasticism

DF II: Technical versus Sociocultural

DF III: Business versus Cultural

Table 4.26: Discriminant Function Centroids for 1960-1965 Career Plans Change Groups

Plan Group (+ = Stable)	DF I	DF II	DF III
1 CS - MED+	65	47	53
2 CS - BIO+	57	46	49
3 CS - RES+	63	42	53
4 CS - ENG+	58	43	48
5 CS - TEC	50	43	49
6 CS - LBR	47	45	49
7 CS - CLK	49	48	45
8 CS - ACT	51	47	47
9 CS - BUS	56	47	47
10 CS - MGT	62	47	47
11 CS - WEL	57	48	51
12 CS - PRF	61	48	53
13 NCT - BIO	48	44	55
14 NCT - ENG	49	42	50
15 NCT - TEC+	41	44	52
16 NCT - LBR+	38	45	53
17 NCT - CLK	39	47	51
18 NCT - ACT	41	48	50
19 NCT - BUS	47	48	49
20 NCT - WEL	48	48	54
21 NCNT - BIO	45	47	49
22 NCNT - ENG	48	48	50
23 NCNT - TEC	41	48	50
24 NCNT - LBR	37	50	51
25 NCNT - CLK+	39	53	50
26 NCNT - ACT+	42	55	48
27 NCNT - BUS	46	56	46
28 NCNT - WEL	47	57	53
29 NCNT - PRF	51	58	58
30 CNS - MED	60	54	56
31 CNS - BIO	54	54	49
32 CNS - RES	61	47	54
33 CNS - ENG	54	50	48
34 CNS - TEC	48	51	48
35 CNS - LBR	44	51	48
36 CNS - CLK	48	58	48
37 CNS - ACT	48	56	49
38 CNS - BUS+	53	57	45
39 CNS - MGT+	57	58	47
40 CNS - WEL+	53	59	53
41 CNS - PRF+	58	59	54

Notice that their arrow points in the approximate direction of the stable CS-BIO group. The tendency of migrant groups to move toward their stable targets in the model is striking, just as it was in Cooley's one-year transition map (Figure 4.1). The result is that the plane in the personality measurement space located by the two functions we have named Science-oriented Scholasticism and Technical versus Sociocultural provides a basis for mapping and predicting career transitions as well as career locations. This model seems worthy of consideration by young people struggling to understand the process of career in our society and to make informed career decisions. We remind the reader that a computer measurement system can map the individual into the model and can provide him with probabilities of membership in the different categories for himself. The model shows him that there are definite probability rules relating personality traits to career plans and what these rules are in detail and in implications for him, but it does not give him the false impression that his future is strictly determined. Rather, it helps him to explore his options.

We have urged the employment of the rubrics and techniques of the MAP factor model of personality primarily because we believe that people need the organization of the many trait indicators into the relatively few factors to expedite their cognitive processing of information in this area. Obviously the computer does not need the factor rubrics. The question naturally arises as to how much predictive validity is lost when the reduced-rank factor model is employed in place of the full 100 indicator measures available. To test our assumption that very little is lost for most career criteria, we ran two studies in both the factor space and the indicator space. The studies are of substantive interest also. For both studies, the criterion variable was the six-category taxonomy of male career plans used in the Project TALENT "One-Year Follow-Up Studies" monograph (p. 183) and described previously in this chapter (c.f. Table 4.4). The variable was scored on one-year follow-up data for 9th-grade sample boys as collected four years after the subjects were tested. Thus the predictors were 9th-grade 1960 scores and the criterion was 1964 one-year follow-up plans. There were two studies because the predictor domains were kept separate. Table 4.27 reports the discriminant analysis using the 11 MAP ability factors as predictors in some detail. It is interesting to note that the three core achievement factors lead the differential aptitudes in validity. At the bottom of the table the replication sample prediction performance of the reduced-rank model is compared with that of the full-rank 60-scale model. In this case nothing is lost by using the MAP ability factors rather than the 60 indicators. Table 4.28 reports the discriminant analysis using the 11 MAP motive factors as predictors. All but one of the motives are significantly related to the career plans criterion, with Science Interests and Scholasticism leading the list of ranked predictors. The bottom of the table indicates that the replication sample prediction performance of the reduced-rank model is a little poorer than that of the full-rank model in this case. We are not inclined to view the loss of prediction performance with alarm, since we value prediction performance primarily for its validation of the heuristic model. The model must have reasonable predictive validity, but the additional criteria of parsimony and memorableness require consideration also. A scientific theory for human cognitive purposes has to be a compromise solution, although a computer-based prediction system need not make the same concessions. Incidentally, the use of fresh replication samples in the two studies under discussion makes it possible to see the models performing true predictions, something seldom achieved in career development research.

We have shown how occupational aspirations can be classified into career plans criterion variables of increasing complexity as career development progresses through adolescence into early adulthood.

We bring this long chapter to a close without a summary because we see that the material on career development it contains needs to be summarized in context with the materials on personality measurement, educational development, and occupations presented in the first three chapters. Now that we have surveyed the

Table 4.27

Discriminant Analysis of Six Vocational Aspiration Groups One Year Out of High School Predicted from 11 MAP Abilities Factors Measured in 9th-Grade on 2939 Male Subjects

MAP Abilities Factors ranked as predictors	Group Means in Standard Scores, College Groups				T = 10 z + 50 Non-College		ANOVA
	Phys Sci (N=558)	Med-Bio (N=312)	Humanity (N=514)	Business (N=656)	Technol (N=576)	Busin-NC (N=324)	F_{∞}^{5}
Verbal Knowledges	55	56	57	55	45	47	136.
English Language	47	49	47	48	41	44	54.
Mathematics	57	54	53	52	51	50	52.
Visual Reasoning	58	54	52	52	54	50	40.
Perceptual Speed and Acc.	48	47	47	49	46	49	8.
Games	52	52	51	53	50	51	8.
Screening							NS
Hunting-Fishing							NS
Memory							NS
Color, Foods							NS
Etiquette							NS
Means on First Discriminant Function	57	56	45	54	43	45	$\Lambda = .59$
Means on Second Discriminant Function	61	56	54	53	59	53	[illegible] = 32.

30% correct classifications achieved in the discriminant space. Chance expectation is 17%.

There were 31% hits achieved in a classification conducted in a discriminant space based on the 60 indicators of the Abilities domain. Maximum number of discriminant functions (i.e. five) were used in both cases.

Table 4.28

Discriminant Analysis of Six Vocational Aspiration Groups One Year Out of High School Predicted from 11 MAP Motives Factors Measured in 9th-Grade on 2939 Male Subjects

MAP Motives Factors ranked as predictors	Group Means in Standard Scores, College Groups				T = 10 z + 50 Non-College		ANOVA
	Phys Sci (N=558)	Med-Bio (N=312)	Humanity (N=514)	Business (N=656)	Technol (N=576)	Busin-NC (N=324)	F^{5}_{∞}
Science Interests	61	58	60	58	53	54	59.
Scholasticism	52	51	52	50	48	46	30.
Outdoors, Shop Interests	55	54	53	54	59	57	27.
Sociability	46	49	50	52	49	50	26.
Activity Level	48	49	47	48	52	53	25.
Conformity Needs	49	49	50	50	45	46	22.
Impulsion	47	48	48	49	51	51	17.
Cultural Interests	43	46	46	45	43	44	14.
Leadership	51	51	52	52	50	50	9.
Business Interests	48	47	48	50	47	49	8.
Introspection							NS
Means on First Discriminant Function	57	55	57	54	45	45	$\Lambda = .69$
Means on Second Discriminant Function	62	56	55	53	58	56	$\chi \cong 27.$

27% correct classifications achieved in the discriminant space. Chance expectation is 17%.

There were 33% hits achieved in a classification conducted in a discriminant space based on the 38 indicators of the motives domain.

The hit rate achieved in a classification conducted in a discriminant space based on the 22 MAP factors of abilities + motives was also 33%.

literature on these topics and added our findings to the accumulation, we need to consider what synthetic view of the development of adolescents into young adults we can achieve, and how this view can serve adolescents now in our schools. Our final chapter attempts to synthesize a career development theory and to describe its deployment in career guidance.

Chapter V

CAREER THEORY AND CAREER GUIDANCE

In the first section of this chapter we undertake to assemble the major generalizations about career development and its origins in personality that we have found in our review of the literature and in our research program. Since all the ideas have been culled from the previous four chapters, we do not again provide citations or details. This is in effect a summary of the monograph.

In the second section of this chapter we deal with the issue of what career guidance should be, given the career theory we have presented. An attempt is made to review what we consider to be the core literature on this subject, and some concepts of our own are added, especially in relation to the possible applications of a computer measurement system to career guidance.

Career Development Theory

For the American male who is not thoroughly alienated from society, career provides one of life's major experiences and themes. His career roles and his other life roles interact so as to modify and support each other. His total system of self concepts which is his identity influences his career and is profoundly influenced by his career. Career is the developmental process by which a person learns about the world of work; acquires work-related values, skills, and habits; develops specific occupational interests and intentions; prepares for and seeks an entry occupation; and creates for himself a long term work history involving a sequence of positions and altered responsibilities, terminating in retirement or death. Career development normally preceeds through stages and substages, one model for which is provided by Table 4.1. This model is a basic construct of career psychology.

An individual's career development is restricted by several categories of variables over which he has little or no control. Biological restrictors of career include physiogomy, somatotype, health, and genetic sources of variance in personality traits, especially intellectual abilities. Socio-cultural restrictors of career include race, age, socioeconomic status of parents, geographic origin, and religion. The influence of sex on both the predictors and the criteria of career development is so sharp as to dictate the requirement of separate theories for the sexes. Current theory concentrates on the critical period of adolescence, but the sex variable "defines and shades all aspects of the developmental crisis" of adolescence. Little progress has been made toward a theory of career development for females, and our generalizations are to be taken as applying only to males.

Career multipotentiality exists for most boys, so that personal initiatives, particularly during adolescence, exert strong influence on career development. Multipotentiality is the opportunity a youth has to develop a career pattern from any one of the stable paths in the career development tree structure. At any branching point in the tree structure, multipotentiality is exhibited as freedom of choice for the individual. General educational attainment enhances an individual's multipotentiality. A primary goal of career guidance is to foster knowledge of personal multipotentiality and its uses. Multipotentiality is a key construct of career psychology, both as standing for a fact and for a value.

Career pattern is a scientific classification of the sequence of major career decisions made by or for a person over his life period. The career development tree structure diagrammed in Figure 4.1A is a taxonomy of stable career patterns. Stable patterns as defined by this model are exhibited by about 40 percent of American males and occur because career decisions are to some extent irreversible . Irreversibility is the gating action of a decision at a major branching point, preventing the retracing of the junction. A stable career pattern is one in which all branching has the force of gating. An unstable career pattern is one in which at least one branching is retraced and reversed. In the career tree, the twelve diagrammed paths are stable patterns, while unstable patterns belong to individuals who jump from one diagrammed path to another at least once. The incidence of stable patterns, while moderate, is high enough to insure that a simple probability law, perhaps of the Markov chain variety, will be fairly successful in accounting for career pattern data. It is also high enough to insure that the best simple prediction of a subject's future career placement is obtained from his present career plan or placement.

The starting point for building a more complex and powerful career prediction model is the research finding that there is a unique and discriminable centroid (profile of means) for each career pattern in a suitable personality measurement space. The conditional probability of membership in a career pattern, given a person's measurement profile, is a known function of the person's generalized distance from the centroid for that career pattern. The best prediction model combines this conditional probability with a probability based on the current career plan of the person. Obtained predictions will be fairly sharp, *but not so precise as to represent a prescription*. The kind of prediction statement the youth seeking career guidance should receive from a computer measurement system is a prediction of the distribution of possible outcomes for a person with his present plan and attributes, and not a prediction that he will emerge in one specific career category. We now have both the necessary empirical research findings and the computerized statistical model to enable us to provide such predictions.

We do *not* assume as many theoreticians do (cf. Holland, 1966, 5-6) that each occupation has its own personality syndrome, or that success and satisfaction in an occupation depend upon similarity of the subject to the group centroid. In fact, we assume that the occupational model is almost irrelevant for career psychology. We

$$\underset{\text{(time 1)}}{\text{trait profile}} \longrightarrow \underset{\text{(time 2)}}{\text{occupation}}$$

point to the extremely weak predictive validities of this model (cf. Thorndike and Hagen, 1959; Ghiselli, 1966). There is much more need for theory to explore and adolescents to learn about the "continents" of the world of work than for focus on specific occupations. Even adults should be encouraged by our theory to think of themselves as possessing particular sets of general vocational capabilities rather than as skilled at particular jobs. General vocational capabilities can be organized in a lattice with a hardware-to-people continuum and a hierarchy of psychomotor and cognitive complexity of tasks as the two dimensions (Altman, 1966).

The career development tree structure exhibits the lawfulness of stable career patterns which is the partial source of career predictions. The other source is what we call the psychometric law or career changes. Our research and that of others shows that migration from one stable career path to another (or, path-jumping) tends to take the individual to a path for which he is closer to the centroid. That is, changing plans so that his career pattern is classified as unstable usually decreases the generalized distance of the individual from his group's centroid in a suitable personality measurement space. This change law is perhaps the most significant finding of psychometric research on career variables. Figure 4.1 illustrates such a finding.

Experience to date has shown that the useful career criterion variables are most often membership variables rather than ordinal or continuous variables. Discriminable career criteria are usually simple one-way category schemes with a small number of cells. The research strategy based on multivariate normal statistics and described in Table 4.2 seems to be useful for researching such career criteria. The twelve-category psychometric taxonomy of careers provided by the paths of the tree structure is a most useful career criterion variable. Those interested in occupations can view its twelve categories as they appear at the branch tips as providing a taxonomy of occupations, since every occupation belongs in one of the cells. Table 4.11 defines the twelve cells.

One reason the tree structure paths appeal as a criterion variable is that they are built up by a series of dichotomous branchings at levels that relate to the stages of the developmental process. This sequential dichotomization provides an easily cognized basis for the career criterion. The sequence of dichotomization rules is:

1) people - thing orientation,
2) college - noncollege intention,
3) college field if college or post high school training or not if noncollege,
4) graduate school or not if college.

For a variety of reasons, orthogonal (uncorrelated) factors in two domains, abilities and motives, seem to provide an appropriate, adequate representation of personality trait information for predictor variables in career psychology. We have researched one such set of measurement rubrics, called the MAP factors, using Project TALENT follow-up data. It has been shown that for adolescents these

MAP factors have a structure within any sex-grade group that is approximately the same for all sex-grade groups. Change in factor status during adolescence is by increments that can be predicted from a set of linear models with correlated means parameters and essentially uncorrelated individual differences parameters. For the abilities domain, retest research shows a minor structural change variable based on correlated changes in Verbal Knowledges and English Language. The retest research also shows that the most stable and predictable dimension of abilities over four years of high school is a contrast of the form,Verbal Knowledges - (English + Mathematics). Twins study research shows that the MAP factors are differentially genetically controlled. Verbal Knowledges seems to be genetically determined to about 70 percent of variance. Genetic determination of variance in the other MAP abilities seems to be inversely related to environmental press, especially sex-role press, on the development of the factor. Perhaps the major impact of twins study research is that review of genetic considerations leads us to affirm the "absolute uniqueness of each individual." With respect to sex, boys as a group score higher than do girls on the MAP abilities factors of Verbal Knowledges, Visual Reasoning, Mathematics, Hunting-Fishing, and on the MAP motives factors of Outdoors and Shop Interests, Science Interests, Impulsion, and Activity Level. Girls score higher than boys on the abilities of English Language, Perceptual Speed and Accuracy, Memory, and the motives of Conformity Needs, Business Interests, and Cultural Interests.

Evidence was presented for the proposition that alternative operationalizations (or, instrumentations) for the MAP factors are possible. Realization of such alternatives would be an important asset to research and to school guidance programs.

A series of multiple group discriminant analyses has shown the following career criteria to be contingent upon MAP factor profiles of male subjects:

Predictors	Criterion
9th-grade MAP	12th-grade curriculum
12th-grade MAP	12th-grade curriculum
9th-grade MAP	high school dropouts
12th-grade MAP	type of college
12th-grade MAP	Astin factor profile of college
12th-grade MAP	graduate school enrollment
12th-grade MAP	college major field
12th-grade MAP	graduate school field
12th-grade MAP	40 occupational groups five years later
12th-grade MAP	marital status five years later
12th-grade MAP	12th-grade 12-category career plans
9th-grade MAP	6-category career plans one year out of high school
12th-grade MAP	12-category career plans five years later
12th-grade MAP	41 career plans change groups.

There is a particular plane in the MAP factors measurement space which is usually nearly optimal for displaying career criterion group separations in two dimensions regardless of which criterion variable is involved. The major axis for this plane has been named Science-oriented Scholasticism, and is located by high loadings on

+ Verbal Knowledges
+ Mathematics
+ Scholasticism
+ Science Interests.

The minor axis for the plane has been named, Technical versus Sociocultural, and is located by high loadings on

- Mathematics
- Visual Reasoning
- Outdoors and Shop Interests
- Science Interests
+ Cultural Interests
+ Sociability

From this description of the best discriminant plane one can see which of the MAP abilities and motives factors are most relevant to career psychology.

Of course, the MAP factors only partially represent the individual differences which are the mediating mechanisms in the shaping of personal initiatives for career development. A list of mediating mechanisms would include:

- hierarchy of needs
- abilities and motor skills
- values and interests
- plans and strategies
- sense of agency
- time perspective
- identifications
- role repertoire, imaginary and overt.

These mechanisms are supposed to be organized into behavior potentials primarily by the self concept system, so that the state of this system is the immediate source of career behaviors. The self concept system incorporates the individual's emerging awareness of his own trait profile. Awareness of traits is part of a set of understandings that contribute to vocational maturity. Role playing, covert and overt, is the chief mechanism by which compromise is created in career development, since role playing encourages reality testing.

Perhaps the single most critical mediating mechanism in the career process is the emergent system of values. Possession of adequate information and of good information processing strategies is important to good decision making, but the subtlety of good evaluation makes this final stage of decision most elusive and most difficult to teach. Some aspects of the values of adolescents are quantified by the MAP motives, but much is missing. We wish we had had something like the Allport-Vernon-Lindzey "Study of Values" among our MAP indicators, for example. If, as we hold, self knowledge is vital for the improvement of career initiatives, then the ways in which people can acquire excellent value systems and learn to deploy them in their living of their careers loom as especially profitable research problems for career psychology.

Finally, we observe and applaud that psychologists studying career development and career guidance have not refrained from mixing their own values with their theories. In this respect career psychology is an eminently human and humane enterprise, if therefore somewhat less scientific than it could be. In the construct of vocational maturity the psychologists have provided a vehicle for their personal values. Those developed attributes of an individual which mediate his achievement of career goals are judged to be elements of a vocational maturity syndrome. What the career goals are is decided by the psychologists. In the formulation of statements of career goals, or career development tasks, the psychologists have created ideals or standards by which to judge human performances. The concept of a continuous process which progresses through stages and terminates only in retirement or death has stimulated the formulation of intermediate goals for each of the stages and substages. In early adolescence the specified goals form a set of awarenesses that Super has termed "planfulness." The needs at that age are dramatized by the evidence that about 50 percent of ninth grade boys are not ready to make a high school curriculum choice on any valid grounds.

Through career guidance, counseling psychologists generally seek to sponsor in youth a definite value orientation. The orientation which we would like to promote may be called rational humanism. We discuss it at length in the second part of this chapter. To the extent that youth accepts rational humanism as a personal philosophy, intermediate goals for career development in late adolescence include:

a personal value system,
a personal decision system,
knowledge of personal multipotentialities,
a long range life plan,
self direction (autonomy),

understanding of human condition,
contributing membership in society
(which includes the possibility of being a
radical reformer).

The long range goal of career development has been termed "integrative vocational adjustment." The career behaviors of the integratively adjusted adult are characterized by self control, personal and social responsibility, the formation and use of ideals, and reasonable compromise. They lead him, with any decent luck to satisfaction and success in his career.

Career Guidance

Career development is a continuous process spanning childhood through adolescence and into adulthood. Career guidance programs need to have the same extensivity. "The process of vocational guidance, rather than resting on a single decision point should be regarded as a series of exploratory experiences, each requiring evaluation as to its significance for future career development" (H. F. Cottingham, in Hopke (ed.), 1967, viii). This series of experiences should include some experiences with counseling, but must include a wide variety of other types of activities. The spectrum of types of experiences structured by the guidance program should be so broad that we may speak of a guidance curriculum. The guidance counselor who operates this curriculum has to be much more interested in the accomplishment of career development tasks by the counselees than he is in any particular method of counseling. Krumboltz (1965), in defining what he calls "behavioral counseling," says that we need to "learn more about what activities can be used to bring about the types of behavior changes"(p. 387) that are indicated for or sought by the client. One example he gives of a possible activity for counselors to sponsor is: "Developing a school marking system so that even the poorest student in each class can be encouraged by seeing the extent of his own progress"

(Krumboltz, 1966, 156). In such examples Krumboltz makes it clear that the entire methodology of pedagogy is to be tapped in behavioral counseling. His concept of counseling is very much like our concept of guidance.

Behavioral counseling, or school guidance, has a broader purpose than aiding youth in career development. We have seen that Super defines career guidance as helping the student to develop and implement a vocational self-concept system. Surely, vocational self-concepts form a subsystem within a larger system of self-concepts, and only a viable total person can support a fully-realized experience of career. We believe it is a mistake for educators to make a strong distinction between guidance for life in general and career guidance. At best, the purposes and contents of career guidance are particular emphases within a comprehensive guidance program.

The overall goal of the guidance program is beautifully described by Stewart and Warnath (1965) as "assisting an individual to develop a well delineated sense of identity" (p. 19). Identity is knowing who one is, where one comes from, and where one is going. It presumes a personal set of values, personal life goals, personal strategies, and acceptance of personal responsibility for success and failure. It requires understanding of personal history and of personal strengths and weaknesses. It requires autonomy and affiliation, love of self and love of others. Aspiration and optimism are necessary ingredients. The process of developing identity is the development of a mature, healthy, productive self-concept system. Identity is "becoming" in that it is never completely realized.

All the best in general education and in general culture (especially family and religious culture) conspires to foster identity in youths, but in our view the guidance program is uniquely positioned to guarantee that all these manifold positive influences are brought into focus so the task is accomplished and certified. Given the hit-or-miss diversity of our educational and general culture today, some one agency has to be charged with insuring that every youth receives maximum encouragement and assistance in an effort to turn himself on as a human being. With Stewart and Warnath, we think the school guidance program is the appropriate agency to be so charged.

This charge to sponsor identity requires the school guidance program to teach a philosophy of life, a specific philosophy that may be alien to some youths in the light of what they learn at home or in the neighborhood, and a philosophy which is at least implicity opposed by powerful forces in our contemporary society. So be it. Education always has to stand for something. The philosophy to be taught is rationalistic and humanistic. Its roots are in the Judeo-Christian traditions and in the tradition of eighteenth century Anglo-American democratic thought. Its chief precepts are:

Self Knowledge
Personal Responsibility
Loving Involvement in Humanity.

The juxtaposition of Self Knowledge and Personal Responsibility involves a paradox. Henry (1966) observes that "fear of failure is the dark aspect of the hope and striving for success" (p. 137), and that to reduce our experience of vulnerability so that it does not cripple our efforts to achieve, "we must know our strength. Nobody is invulnerable but nobody is as weak as he thinks he is either" (p. 145). We agree that the self knowledge gained from guidance experiences should emphasize strengths, or potentialities O'Hara (1966) has observed that "the concept one has of one's self influences one's achievement to a significant degree" (p. 111), so that it is important for students with good aptitudes for specific objectives to know that they have those potentialities. The paradox is that the information for self knowledge has to come to a great extent from social science researches based on a deterministic model of behavior, yet it is crucial that the youths not apply the deterministic model to themselves. Bahn (1966) has observed that "an individual's belief in responsibility for his own actions is itself a highly significant behavioral variable" (p. 148). We endorse his assertion that "the concept of individual responsibility should be taught as a general belief and demand" (p. 149).

Planning and evaluating personal history provide the content for learning and practicing self-knowledge and autonomous discipline in the guidance curriculum. Tiedeman (1966) says "the context of guidance is primarily that of facilitating personal initiative" (p. 18). He emphasizes that there is a linguistic analysis of discovery which students should learn. In this analysis, discovery consists

> 1) of defining a problem, 2) of inventing alternative explanations for the phenomena observable in relation to the problem, 3) of undertaking observations designed to foster elimination of competing explanations, 4) of investing the more plausible explanations with belief held in a committed but tentative fashion, and 5) of operating as if the belief were true until such time as further relevant evidence from personal or shared experience causes the person to tumble the whole explanatory system about again in search of new crystallizations. (Tiedeman, 1966, 12)

The hallmark of this approach to guidance is that the student acquires cognitive procedures for operating his intelligence effectively, not just information or prescriptions.

> Because this science-like procedure can be expressed linguistically the teacher can acquaint students with the language of scientific procedure while engaging them in the actual process of discovering. (ibid., 12)

Tiedeman's rationalism requires that insight precede and foster responsible action. He is able to define insight in a way that makes its occurrence testable.

> Students who develop an understanding of the procedure of discovery possess the capacity for realization of insight. Understanding presumes the capacity to offer accurate explanation of the procedure of discovery in relation to discoveries which are taking place. (ibid., 15)

It is through insights achieved by formal analysis of discoveries that the student comprehends himself. We concur with Tiedeman in insisting that the guidance program should be organized to encourage such insights. This means a guidance program that begins in kindergarten and extends its services through all the years of formal education and beyond into extension services for adults, because comprehension of self is a lifelong job and is never completed.

It means a strong curriculum focus on the capacity to reason, to treat the self as an object of analysis, to relate self to imagined, potential futures. It means finding ways to accomplish these self understandings for people of all levels of intellectural aptitude. It means that guidance counselors must undertake to lead public education into an existential mode in which students become the subjects rather than the objects of education. In this new mode, self becomes the center of education ("your" self and "his" self as well as "my" self, for an absolutely essential part of this world view is the valuing of other selfs at the same level as of myself) and personal and collaborative initiatives the proof of education. The student "comes to know himself, not as an immutable object, but as a process in which the expression of personal initiative brings him into collaborating contexts with the personal initiatives of others" (*ibid*., 21). Only such a student can have the *sense of agency* that is required for vocational maturity.

In his Presidential Address to the Division of Counseling Psychology of A. P. A., Tiedeman (1967) hammers at the theme that it is the counselor's task to promote a particular set of cognitive holdings that enables the student to reflect upon action.

> Understanding and appreciation of goal and choosing predicaments is a primary educational goal. (Tiedeman, 1967, 2)

Insights into the predicaments of the human condition are key elements of the required set of cognitive holdings. Among these paradoxes the individual needs to confront and master are two kinds of goal predicament.

> 1. Current goals require commitment; yet personal development requires tentativeness toward the consequences of an immediate choice;
>
> 2. Current choices require implementation; yet personal development calls for reflection on alternative paths of development. (*ibid*., 1)

An even deeper paradox underlies the person's resolve to take action in spite of these goal predicaments. The choice predicament is that every choice is accompanied by the opportunity to refuse to choose.

Human development is not automatic, and in this lies the source of the deepest anxiety we know, which Tiedeman calls choice anxiety. One can flee from choice anxiety; one can refuse to grow in humanity by refusing to *know* the human condition. One is not forced to be reflective and responsible; there are automated people whose actions are merely reactions to the wills of others or the whims of chance. The deepest paradox is that only by accepting the punishing conditions of choice can one experience the glory of being a free personality.

Life poses an endless stream of problems for a person to solve. We are concerned to see that a program of career guidance assists young people in solving those problems that relate to their career development. However, we must not lose sight of the essential human conditions that make personal initiatives in problem solving possible, and we must provide a guidance program that pays attention to the task of establishing these prerequisites to responsible self direction.

Tiedeman has clarified the nature of the personal identity guidance is to foster. He has also anticipated that the pedagogical setting for career problem solving may be substantially automated through a computer system if the human counselor can accomplish the teaching of the human prerequisites to problem solving. Tiedeman and his colleagues are busily engaged in engineering a prototype of such a computer system, of which he says:

> In planning for an Information System for Vocational Decisions, I have deliberately tried to free the counselor from obligation to know and to convey facts/data about occupations, vocations, and careers. At the same time I have attempted to put great professional responsibility on the counselor for seeing to it that a user in turn attempts to put himself into relationship with those facts/data so that he, the user, turns them into information. (*ibid*., 8)

Tiedeman's is not the only group working on a prototype computer guidance system or subsystem. A report on a conference on such work (Campbell, Tiedeman, Martin, 1966) describes eight such engineering development efforts in detail. From all this investment there can be little doubt that a gradual spread of effect will follow, especially since some major corporations in the electronics and communications industries have committed R & D resources in this area. We take it for granted that computer assistance to guidance is a coming reality. Our interest is in the details of how such assistance will work. To document that we are not alone in agreeing with Tiedeman that a particular set of cognitive holdings focused on self knowledge and personal responsibility represents the core of objectives for career guidance, we report the list of objectives for the Learning Research and Development Centers's (University of Pittsburgh) "Computer Information Guidance System" project, as Hummel (1967) and his colleagues have expressed them:

> To help each pupil realize:
>
> 1. Greater understanding of his own abilities and disabilities.
> 2. Greater understanding of his own value preferences and of the way his preferences both are influenced by and yet may differ from those of his family and peers.
> 3. Greater understanding of how his value preferences are influenced by and may differ from those generally advocated and practiced within American society.
> 4. Greater understanding of the relation between certain aspects of his life history and his present behavior and outlook.
> 5. Greater understanding of the educational system especially as its demands and opportunities relate to his personal situation.
> 6. Greater understanding of the world of work . . .
> 7. Greater capacity to apply a rational, problem-solving strategy to his life situations.
> 8. Greater capacity to control his immediate conduct in the interest of longer-range objectives for which he may have a higher value.
> 9. Greater capacity to be flexible, nonarbitrary, in his planning and decision-making; yet concomitantly, a greater capacity to carry out his plans and decisions resolutely and responsibly.

10. Greater willingness to perceive and accept responsibility for the consequences of his own conduct.

11. Greater independence in analyzing his problem situations and arriving at suitable solutions.

12. Greater sense of "agency," of competence to exert personal influence on his life situations.

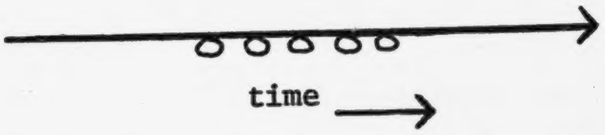
These objectives of a career guidance program are closely keyed to the ingredients of vocational maturity in adolescence, as career development theory defines it. Both career theory and guidance theory stress the cognitive as opposed to the overt action components of achievement of vocational maturity. The personality theory and the educational theory agree that what the adolescent thinks is more significant than what he does. It need not be this way. The theories could emphasize role playing, exploratory work experiences, habituation of social conduct appropriate to anticipated vocations, apprenticeships, and other action variables. The extraordinary concern with "understandings" is the trademark of contemporary theories of career development and career guidance. It is somewhat surprising to find such preoccupation with the "inner man" at a time when the general culture seems obsessed with the "man of action and appearances." There is great appeal in this professorial devotion to personality; one can only hope it is not foolhardy.

Within the large matrix of cognitive structures representing identity in personality, a critical elemental structure discerned by today's guidance theoreticians is the decision-making capacity of the young person. Given that a young person has the world view Stewart and Warnath, Erikson, and Tiedeman describe as prerequisite for self realization, the actual effectiveness of the person in coping with the problems of career development as they materialize sequentially depends in large measure on the strategy of problem solving and decision making he employs. Two very abstract types of behavior theory have been recently influential on guidance theoreticians' analyses of decision making. These two sources are cybernetics or information theory and game theory, both of which are mathematical approaches to modeling behavior. Guidance theoreticians have borrowed the ideas of cybernetics and game theory without making much use of their actual mathematics, so that what emerges is a paradigm of decision making. Gelatt (1962) and his associates at the Palo Alto Unified School District have been especially creative in developing a detailed paradigm of decision making for the guidance context, and in applying it to actual school guidance situations. The main feature of the paradigm is that it requires that the decisions of students be evaluated in light of the goodness of the process by which they are reached rather than by the results they yield. Once again the focus is on cognitive process rather than on external criteria. Two process variables to be scrutinized are 1) adequacy of information inputs and 2) adequacy of analytic strategy. Gelatt proposes that guidance counselors attend particularly to the information bases of students' decisions, since it is easier to judge the relevance, reliability, and completeness of information than it is to expose and evaluate strategies in the area of complex career problems, and also because certain classes of information pretty much dictate the kinds of analysis they require. For example, probability statements derived from social science researches appear to Gelatt to be a crucial class of information relevant to career problems. The nature of probabilities rather clearly delineates their rational uses. Anyway, as Gelatt insists, good information may not lead automatically to good decisions, but good decisions are impossible without good information, as a rule. The implications for research in support of guidance are set forth in a way that closely approximates the purposes of Project TALENT.

> Greater efforts should be made to determine what specific information is relevant to the educational-vocational decisions faced by high school students, to gather and organize that information, and to help students learn to use if effectively. (Clarke, Gelatt, Levine, 1965, 41)

Given such a research base, the task for the guidance program "would be to utilize decision-making opportunities for developing the student's capacity for subsequent decision making. This would require that counselors help students learn to clarify alternatives, to pick out pertinent data, to use these data in their decisions, and to take responsibility for the decisions." (Gelatt, 1962, 244) Gelatt and his colleagues have designed and successfully used with students a variety of curriculum units that contribute to these objectives. They have developed local experience tables to incorporate empirical probabilities in their units. Perhaps their most challenging procedures are group career games in which student teams play against each other to see who can best simulate good career decisions. These curriculum units go a long way toward reducing the roadblock of "the inability of students and parents to assess accurately the probabilities of given alternatives and/or the lack of knowledge of the complete range of possible alternatives" (ibid., 244). Of course, we believe that the Project TALENT research findings should be available to students and parents for their sound and relevant knowledge of alternative goals and their probabilities for different personality profiles.

Recognizing the continuous nature of career development, Gelatt proposes the use of a tree structure model to represent the possible sequences of decisions available to a person. This model is much like that provided by our Career Development Tree, except that by delineating every educational and vocational choice as a branching point it results in a much more detailed tree for each individual. When the model is applied to sequences of play in the career games, Gelatt calls it a "game tree." The sequential flow of decisions in career development makes the concept of a cycle of decision making an essential one. Although important decisions tend to be irreversible, there are no final decisions short of the grave. There is a cycle of problem sensing, information gathering, decision making, evaluation, problem sensing, and on and on. This cycle can be viewed as a cybernetic loop, in which there is continual modification of the behavioral system by the information feedback from the ongoing behaviors. We would diagram this cyclic process this way, to convey



a sense of progression over time toward life goals. The cybernetic loop is constructive and purposeful, unlike, for example, the cycle of the neurotic sympton periodically discharging accumulated tension. The Figure on the next page is Gelatt's (1962, 242) representation of the detailed steps in a single decision-making performance. Note the three stages of strategy for transforming data to information relevant to problem and purpose. The student is required to possess and operate a prediction system and a value system, as well as the will to act on the outcomes of analysis. His action may send him in search of additional data (an investigatory decision) or it may determine an instrumental response to the environmental stimulus situation which triggered the decision-making performance (a terminal decision). It is implied that a finite and reasonable number of investigatory decisions will precede a terminal decision. An endless or excessively prolonged series of investigatory decisions may make a refuge for a timid soul but it will not qualify as a cybernetic loop.

Another feature of Gelatt's decision-making paradigm is its "attention to the interaction among immediate, intermediate, and future decisions. That is, counseling will attempt to help the student utilize the more immediate decisions facing him for the purpose of reality testing and modifying his developing self-concept and thus influence his decisions about more ultimate goals." (1962, 244) We conceive of this interaction of long range life goals and immediate purposes, especially educational purposes, as a primary source of educational motivation in adolescents. We would analyze the process of curriculum as an interior cybernetic loop in which decision making, particulary with reference to sensing of problems and setting of purposes, is conditioned by the exterior guidance

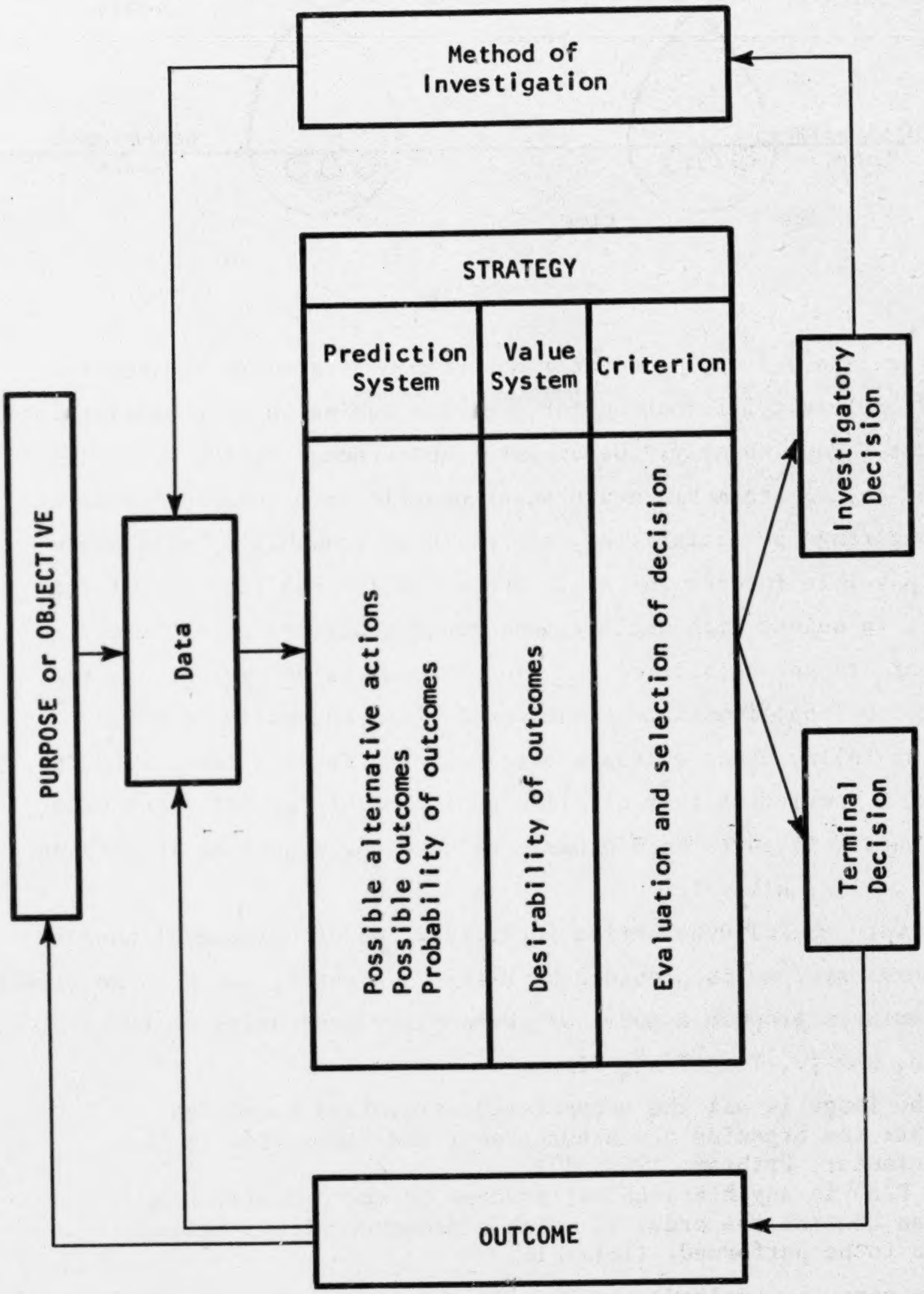
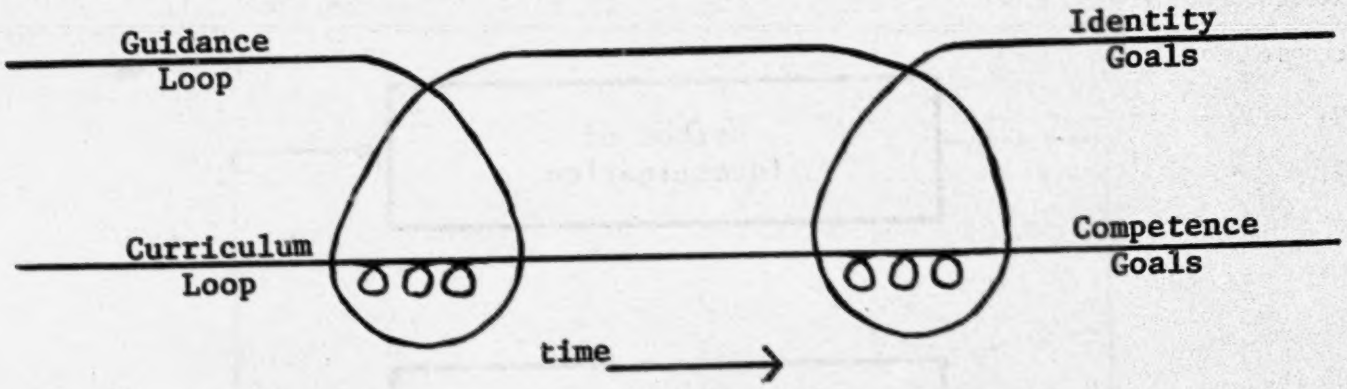

Method of Investigation
STRATEGY
Prediction System
Value System
Criterion
Investigatory Decision
PURPOSE or OBJECTIVE
Data
Possible alternative actions
Possible outcomes
Probability of outcomes
Desirability of outcomes
Evaluation and selection of decision
Terminal Decision
OUTCOME

Fig. 5.1. The Sequential Decision-Making Process (Gelatt, 1962)

loop, as represented by this diagram:



In the guidance loop, a computer measurement system is invoked to provide relevant information for decision making on self realization problems. Particularly, the computer measurement system helps the student to transform his measurement profile into information about his long range potentialities, expressed as probability statements about possible futures for him. The counselor can then assist the student to select high quality long range goals and plans in the light of his potentialities and his personal value system. In the curriculum loop, immediate educational plans and motivation for learning follow these guidance outcomes. Motivation flows from the student's conviction that his life goals and his school plans make sense when related to each other. He sees how schooling is helping him to realize himself.

A very useful cybernetics interpretation of purposeful human behavioral systems is provided by Miller, Galanter, and Pribram (1960). These authors propose a model of personality consisting of two domains, namely, Images and Plans.

> The Image is all the accumulated, organized knowledge that the organism has about itself and its world. (Miller, Galanter, Pribram, 1960, 17)
> A Plan is any hierarchical process in the organism that can control the order in which a sequence of operations is to be performed. (ibid., 16)

Using a computer analogy, the Plan is the program and the Image is the data file. However, a Plan can be part of an Image. Just as the computer can treat a program as a data file, the human being can have knowledge of Plans. The names of Plans must be part of Images in order that the person may be able to name and sort his competencies. The most vital point is that changing an Image requires a Plan. Clearly, a Plan is what Gelatt calls a Strategy, and Images incorporate what we have called Self Concepts, Value System, Prediction System, and Goals. The authors define the domains of personality posited by the MAP factor theory in their terms. They say "a motive is comprised of two independent parts: value and intention. A value refers to an Image, whereas an intention refers to a plan." (ibid.,62). They also say:

> Habits and skills are Plans that were originally voluntary but that have become relatively inflexible, involuntary, automatic. Once the Plan that controls a sequence of skilled actions becomes fixed through overlearning, it will function in much the same way as an innate Plan in instinctive behavior. (ibid., 82) Both skills and instincts are on-going patterns of action, directed toward the environmental conditions that activate and guide them and organize hierarchically into action units with more than one level of complexity. (ibid., 93)

In this theory the basic "action unit" of behavior is an element of a cybernetic loop called a TOTE element, for "Test ⟶ Operate ⟶ Test ⟶ Exit," and the Plan is actually the cybernetic loop composed of a series of these feedback units. We have no argument with the idea of analyzing every personality trait, whether it be an ability or a motive, into an Image component, which we have called a cognitive holding, and an action potential, or Plan. The analysis makes it clear that our sorting of traits into maximum performance and typical performance domains is more of an artifact of our respect for a division between classes of measurement procedures than it is an isomorphism with a real human characteristic. Any analysis that reminds us of the synthetic wholeness of human personality is worthwhile. Both the division of cognitions into Images and Plans and the division of traits into abilities and motives are arbitrary conventions to be justified by their usefulness to the scientist.

Tiedeman (1966) has proposed the notion of a discontinuity in the development of identity to name the points in a life history at which serious developmental problems are confronted. He asserts that it is exactly where discontinuities arise that guidance should intervene to help in the formulation of the problem as a set of answerable questions, and in the acquisition and assimilation of the required information. Guidance provides the opportunity for the student to solve the problem which gives rise to a discontinuity. Guidance does not solve problems for students. For example, if the computer measurement system informs the student that he is pursuing a goal which he has a low probability of attaining, judging from the experiences of people similar to himself, the student can decide to replace the goal in question or he can seek information on how he might operate on his own status on the critical trait predictors which produce the low probability, in an effort to improve his chances by improving his qualifications. Thus the computer measurement system never forces a student to abandon a goal, although it may return some discouraging information about its availability as matters stand. The measurement system can always be interrogated about the ideal measurement profile that seems to be the right "ticket" for a specific goal. A ninth grade student shown the twelfth grade measurement profile that appears to be the right "ticket" for a goal he is interested in might be challenged to work to bring about the suggested adjustments in his measurement profile during the high school years. The young person is not confronted with a status situation and its inevitable implications, but is shown an opportunity he has to qualify himself for the future he desires. He can see that his situation is not deterministic, but that its probabilities are a function of his goals and his personal attributes and that both are subject to change.

In an analysis of the rationale for guidance which ranks with those of Stewart and Warnath and of Tiedeman for its comprehensive and convincing nature, Katz (1963) aligns himself with the emphasis on process rather than on product.

> We don't know what the content of any individual's ultimate choice should be and we hesitate to direct him according to our own best judgment of what it should be. But we do think we can help him in the process of choosing. This emphasis on process cannot pretend to insure the "right" choice; it rests on the assumption that, in education, enlightened processes are intrinsically important. We have a bias--a conviction --in favor of informed and rational choice. (Katz, 1963, 23)

Katz also subscribes to the self-concept approach to vocational maturity, and he points out that in the interaction of self concepts and decisions each factor influences the other, so that the self concepts that shape decisions are in turn modified by those decisions and their results. Again we see a version of the cycle construct. Katz calls the awareness of a developmental task a disequilibrium, where Tiedeman calls it a discontinuity. For Katz, the outcome of an act of decision making is a new integration of self.

> Each reintergration establishes a new equilibrium. Events--the perceptions and interpretations of outcomes--will maintain or upset this balance between self-concept and reality. Guidance may then consist of helping the individual to test and reinstate his "mobile equilibrium" at appropriate times in a rational way. (ibid., 15).

Katz is especially concerned to describe the role of a personal value system in the client's decision making.

> If values are truly the major synthesizing elements in decision-making; if they order, arrange, and unify the student's perceptions of traits and social forces; if they muster these perceptions for a particular decision or for a mode of choosing--then indeed the student's exploration and examination of values must be of prime concern for guidance. (ibid., 17)

We are naturally interested in describing the ways in which psychometric information can serve in the decision process, but we are willing to acknowledge that the maintaining and deploying of a viable and satisfying set of values is absolutely central to the process. When the student has a consistent value system, Katz says that guidance should help him to monitor trends in its evolution, and to "try on" in imagination some of the alternative values in a "what if ..." mode of thought. Katz argues that it is not the function of the guidance counselor to champion any single set of values. "Rather, he has, throughout the secondary student's career advocated a full examination of each set of values." (ibid., 58) We think Katz would agree, however, that guidance counselors should champion the superordinate values of self knowledge, personal responsibility, and altruistic humanism. Katz presents an excellent appraisal of the relationship of trait-and-factor psychology such as our Project TALENT career development studies to career psychology.

> However, if trait-and-factor theory is limited only to the making of predictions and is not extended to the determination of decisions, it is not a theory of occupational choice at all, but only one element that can be worked into a more comprehensive theory of occupational choice. Perhaps it may best be regarded as an expression of the reality element that affects occupational sorting. It encompasses observations of what happens with particular reference to the content of choice and the results of selection, but does not penetrate beneath the surface of events to explain the process of choosing or to furnish a clear rationale, for intervention in that process. (ibid., 13)

Exactly, and that is why we are striving to place our trait-and-factor research results into the context of theories of career development and career guidance.

Culturally disadvantaged youth are especially in need of the guidance program we envision. Stevig and Uhlig (1967) report that "one of the major problems in raising the occupational aspirations of Appalachian students appears to be lack of information and opportunity rather than lack of ability."(p. 435) Stewart and Warnath (1965) make two suggestions which the proposed computer measurement system could implement.

> In helping disadvantaged youth assess their chances for success,... one strategy would be to point out to these youth the areas in which their probabilities of successfully competing in society will be greatest over the long haul. ...Another way in which the school counselor might assist minority groups would be to make youth aware of individual differences in all groups. (p. 132)

Stewart and Warnath also speak of the importance of the personal value system.

> Although the counselor should expose students to information about themselves and their world, he will need to develop understanding of and sympathy for the fact that there are many legitimate value orientations from which to evaluate this information. Evaluations from the different value orientations do not always lead to the same conclusions. (p. 133)

These authors visualize a role for the statistical and computer methods we would like to see engineered into a computer measurement system for guidance.

> Multivariate analytic procedures offer a considerable amount of promise for improving the use of test batteries for purposes such as describing well-defined samples (e.g., college majors) and predicting multiple and complex criteria. These techniques are especially appropriate for interpreting and using profile-type information--a type of information the school counselor uses almost daily. Heretofore, counselors have relied primarily on inspection to judge whether two profiles are different. Multivariate techniques have been available for more than two decades but computational procedures were too laborious for the techniques to be practical. The use of computers has resolved the computational difficulties and has made the techniques available to the counselor at negligible cost. However, the counselor must understand the underlying rationales of the techniques in order to interpret findings obtained by their use or to apply them correctly. (ibid., 252)

It is somewhat surprising to find Stewart and Warnath stressing the counselor's need to understand the statistical models by which the computer relates measurement profiles to career criteria, when in fact it is the student who is receiving the information who most needs this understanding. Before a computer measurement system can realize its potential for enriching the information environment of the guidance program, suitable guidance curriculum units will have to be provided to instruct students in the rudiments of trait-and-factor psychology and its quantitative models.

In a previous proposal for a computer measurement sytem for guidance, profile interpretation via multivariate statistical procedures was selected as the most obvious initial information function for such a system.

> What has been needed is a summary of this test score evidence with respect to particular questions, questions with educational and career relevance for each student. (Cooley, 1964, 561)

A key concept in that presentation is the notion of "programmed experiences," which would be examples of what Cronbach (1965) calls macrotreatments in response to individual differences, to differentiate them from the series of microtreatments incorporated in "programmed learning units" or teaching machine programs. Programmed experiences might or might not involve programmed learning units. The macrotreatment units could be such experiences as books, films, interviews, field trips, part-time employment, discussion groups, etc. Essentially, they would be whatever educational prescriptions that would help a student solve his problems. In the decision-making paradigm, these could be made available in a resource collection from which the student could make his own selections. The point is that not only can the computer system help the student to locate his problem by revealing a discrepancy between aspiration and potential, but it can also help the student locate resources that can be assembled into a program of study designed to reduce the problem. Flanagan (1967) has asserted that "schools make inadequate provision for the very large individual differences to be found in any age or grade group."(p. 2) Similarly, Cronbach (1965) charges: "Most tactics the school uses are intended to minimize the nuisance of individual differences so that it can go on teaching the same unaltered course."(p.6) The guidance curriculum we are proposing should maximize attention to relevant individual differences. A computer system for guidance can make it possible to do this by keying the information response to queries in every instance to the unique measurement profile and other descriptive characteristics of the individual student doing the querying.

Cronbach (1965) specifically endorses the conception of programmed experiences in guidance, but he warns against premature over-differentiation.

> It seems likely to me that even with the sort of multivariate testing a computer can provide, we will have to build up adaptations slowly, on the basis of only a few differential variables. While in principle a unique instructional diet could be matched to the student's idiosyncratic intellectual metabolism, nothing is to be gained by introducing unvalidated modifications. And it will be a long time before we have adequately validated rules of adaptation that take into account even a half-dozen differential variables. (p. 20)

Essentially, Cronbach phrases our reply to critics who think that the MAP factor profile in terms of a half dozen key abilities and a half dozen key motives is not rich enough to be the basis of a measurement system for guidance. If the student and the computer can be taught to interact constructively in relation to this truncated profile on the basis of sound research knowledge, it will be time enough to consider elaborating the profile with additional traits.

There is one personal characteristic beyond the sex and grade of the student which the computer system must consider simultaneously with the MAP factors profile if the interpretations and predictions it renders are to be as sharp as possible, and that is the current career plan of the student, expressed in terms of one of the categorical variables of the Career Development Tree. Our studies show that the current career choice category is about as good a predictor of future career placement as the entire MAP profile, and the two types of information work together in powerful fashion. Holland and Lutz (1967) have also reported on the value of current plans as a predictor.

> In short, we can predict vocational choices most accurately by one of two simple methods: (1) ask the student about his first two vocational choices, or (2) ask him once about his vocational intentions and then ask him for his preferred vocational role. Either of these methods is almost twice as efficient as the Vocational Preference Inventory. (p. 12-13)

The procedure we propose to incorporate in the computer system for combining current plans data with factor profile data in predicting probabilities of future memberships is based on a classification probabilities model provided by Geisser (1964). Somewhat simplified for expository purposes, Geisser's model combines by multiplication a prior probability of a classification event and a posterior probability for the same event computed from the subject's measurement profile and the estimates of parameters for the various criterion groups in the multivariate normal space. If the subject's current plan is not considered, the vector of prior probabilities for the criterion groups is the same for all subjects, and is based on the best census estimates of the relative group sizes. The new proposal is to estimate from research data a separate vector of prior probabilities for each of the current plans categories. There can be a lot of differentiation among these prior probability vectors for the different current plans categories, leading to considerable influence on the combined probabilities for a subject of which prior vector is selected to multiply his posterior vector.

More technically, TALENT research will allow estimation of k different prior probability vectors q_k of n career plan categories at state t_o, each vector containing m probabilities (actually, proportions) for transition from the given plan category at state t_o to one of m categories available at t_1. These m elements of q_k, $k = 1, 2, \ldots, n$, sum to one (1.0). For the i th subject, his posterior probability vector p_i is computed from his factor score vector and the estimates of parameters of the m multivariate normal swarms, using Geisser's formula. This posterior vector p_i also has m elements and sums to one. Now the particular prior vector corresponding to this subject's current plan category is selected from among the n different q vectors. Let it be q_k. The product of each element of q_k times the corresponding element of p_i is formed, and these products are arrayed in the vector r_i, where $r_{ij} = q_{kj}\, p_{ij}$, $j = 1, 2, \ldots, m$. Finally the product vector is scaled so that the predicted probabilities for the m criterion categories sum to one. $\text{prob}_{ij} = r_{ij} \Big/ \sum_{j=1}^{m} r_{ij}$

We propose to call classification probabilities arrived at by the use of prior probabilities contingent on current career plans by the name prognostic probabilities. Such probabilities combine the current plans data and the MAP factors profile data to give the best prediction possible from the two sets of data. For some questions these predictions will be quite sharp. Cautiously interpreted, they may be very useful indicators to the young person of his potentials. The system will admit that odds exist to be beaten by determination or grace, but will suggest that it can be good to know what the odds appear to be.

We have previously described the functions that might be assigned to a computer measurement system in American schools (Flanagan, et al., 1966, Chapter 11). We visualize computer-based management of (1) the student cumulative record, (2) the student progress report, (3) the appraisal of educational productivity of curriculum and staff, (4) the projection of career potentials for students, (5) the periodic monitoring of individual learning prescriptions, and (6) the provision of several kinds of continuation services to alumni. All of these functions would be managed by new, dynamic models incorporating the cybernetic principle in which measurement is a continuous activity and there is regular feedback of statistically analyzed information to all control agents, including the student himself.

The key concept in the design of a computer measurement system for education is that planning for the immediate educational experiences of a student should be conducted in an information environment incorporating the long range purposes and goals of the student, the known requirement for achievement of those goals, the appraised educational aptitudes and attainments of the student, the appraised interests and other relevant learning sets of the student, the computed probabilities of the long range goals in the light of all these considerations, and the curriculum and staff resources of the school. Only the computer can operate the complex calculus required to process all this data simultaneously for the student.

This concept implies a productive integration of guidance and classroom teaching, leading to a unique educational plan for each student. The plan is to be monitored and adjusted continuously. In this radically renovated school the process of education would be managed by a true process model. Much that is traditional in schools now, like grades, marks, tracks, and group prescriptions would vanish. The better would replace the good. Today's science and technology insure that we are not urging the impossible. A computerized cybernetic information system in a career guidance program at the kernel of a total guidance curriculum which interacts with a renovated teaching-learning methodology can provide a school for tomorrow in which the processes of personal, social, and career development are maximized for each unique individual.

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Appendix A
Estimating MAP Factors for Retest Data
(see "Studies of Change," Chapter 1)

The procedure is to compute a new set of score coefficients for MAP factors by regressing them on the 48 available tests:

$$\beta_{(48,6)} = {R^{MAP}_{(48,48)}}^{-1} \; A^{MAP}_{(48,6)}$$

In this notation, $\underline{R}^{MAP}$ and $\underline{A}^{MAP}$ are the test intercorrelations and factor pattern from the original MAP analyses, trimmed of the coefficients for the 12 missing tests and the five discarded factors by removing appropriate rows and columns from the matrices. The resulting set of β weights produce regressed factor scores of less than unit variance, so the variances or squared multiple correlations are computed and divided out of the β system to give score coefficients $\underline{C}$ for estimated factors:

$$R^2_{MULT_j} = \sum_{k=1}^{48} a_{kj} \, \beta_{kj}, \quad j = 1,2,\ldots,6,$$

$$C_{(48,6)} = \{c_{kj}\} = \frac{1}{R_{MULT_j}} \, \beta_{kj} \quad ,$$

$$\therefore \; C' \; R^{MAP} \; C \cong I.$$

That is, we expect the dispersion of the resulting estimates of six MAP factors to be approximately an identity matrix.

The next step is to transform Shaycoft's 96th order test-retest correlation matrix, $\underline{R}^{MFS}$, in which the first 48 rows and columns are the ninth-grade tests and the last 48 rows and columns are the 12th-grade results on the same tests and for the same subjects, into a twelfth order test-retest matrix for the six MAP factors. The computation is eased by the following partition theorem:

$$\tilde{C}_{(96,12)} = \left[\begin{array}{c|c} C & 0 \\ \hline 0 & C \end{array}\right] ,$$

$$R^{MFS}_{(96,96)} = \left[\begin{array}{c|c} R_{9,9} & R_{9,12} \\ \hline R_{12,9} & R_{12,12} \end{array}\right] ,$$

$$X_{(12,12)} = \tilde{C}' \; R^{MFS} \; \tilde{C} = \left[\begin{array}{c|c} X_{9,9} & X_{9,12} \\ \hline X_{12,9} & X_{12,12} \end{array}\right] ,$$

where

$$X_{9,9\,(6,6)} = C'_{(6,48)} \; R_{9,9\,(48,48)} \; C_{(48,6)}$$

$$X_{9,12\,(6,6)} = C'_{(6,48)} \; R_{9,12\,(48,48)} \; C_{(48,6)}$$

$$X_{12,12\,(6,6)} = C'_{(6,48)} \; R_{12,12\,(48,48)} \; C_{(48,6)}$$

$$X_{12,9} = X_{9,12}'$$

The result $\underline{X}$ is the required matrix of correlations between and across ninth- and twelfth-grade MAP factor scores estimated for the retest study subjects. This matrix requires computation separately for the males and females. Table 1.6 reports these matrices.

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